A QUALITATIVE ASSESSMENT OF B-SCAN FINDINGS IN PATIENTS WITH CATARACT OF MEDIA CLARITY OF GRADE 4

By

DR PATEL APARNA NILESH, MBBS

Dissertation submitted to

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH

TAMAKA, KOLAR – 563101

in partial fulfillment of the requirements for the degree of the

MASTER OF SURGERY

IN

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Under the guidance of

Prof. Dr. Manjula T R. MBBS, M.S,

DEPARTMENT OF OPHTHALMOLOGY

SRI DEVARAJ URS MEDICAL COLLEGE

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2023

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ABSTRACT

NEED FOR THE STUDY

Cataract is the primary cause of blindness, accounting for approximately 3% of treatable blindness. A number of factors stand in the way of treatment of blindness after correcting cataracts, which include posterior pole pathologies like retinal detachment, vitreous detachment, and choroidal and scleral pathologies. The posterior segment can be evaluated using ophthalmoscopes, a slit lamp with a 90/78/60 mirror and a Goldman 3 mirror. The visual prognosis depends on the integrity of the posterior pole.

With dense/advanced cataracts, the posterior segment cannot be visualized with optical instruments, and hence USG- B scan compliments the diagnosis.

The incidence of mature and hyper mature cataract at RLJh hospital is 60%. Most of these patients do not have any records of previous ophthalmic evaluation, many a times the first ever ophthalmic evaluation as a part of pre-operative workup is at RJLH.

The patients undergo routine evaluation and cataract surgery as per the protocol of the RLJH.

The first postoperative day vision, which reflects the cataract care, is noted, and any sub-optimal visual recovery in uneventful cataract surgery is evaluated for a possible correlation with the USG B scan finding.

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LIST OF ABBREVIATIONS USED

VD	Vitreous detachment
IOFB	Intra ocular foreign bodies
PHPV	Persistent Hyper-plastic Primary Vitreous
RD	Retinal detachment
PCIOL	Posterior chamber intro-ocular lens
RD	Retinal detachment
RE	Right eye
LE	Left eye
DR	Diabetic retinopathy
IOP	Infra-ocular pressure
PVD	Posterior vitreous detachment
HRBU	High resolution B-scan ultrasound
PRF	Pulse Repetition Frequency
SICS	Small incision cataract surgery
PSC	Posterior Subcapsular cataract
NS	Nuclear sclerosis
SMC	Senile Mature cataract
SHMC	Senile Hypermature cataract
CF	Counting fingres
PL	Perception of light

PR	Projection of rays
HM	Hand movements
MVO	Mid vitreous opacities
NIPH	Not improving on pin hole

ABSTRACT

NEED FOR THE STUDY

Cataract is the primary cause of blindness, accounting for approximately 3% of treatable blindness. A number of factors stand in the way of treatment of blindness after correcting cataracts, which include posterior pole pathologies like retinal detachment, vitreous detachment, and choroidal and scleral pathologies. The posterior segment can be evaluated using ophthalmoscopes, a slit lamp with a 90/70/80 mirror and a Goldman 3 mirror. The visual prognosis depends on the integrity of the posterior pole.

With dense/advanced cataracts, the posterior segment cannot be visualized with optical instruments, and hence USG- B scan compliments the diagnosis.

The incidence of mature and hyper mature cataract at RLJh hospital is 60%. Most of these patients do not have any records of previous ophthalmic evaluation, many a times the first ever ophthalmic evaluation as a part of pre-operative workup is at RJLH.

The patients undergo routine evaluation and cataract surgery as per the protocol of the RLJH.

The first postoperative day vision, which reflects the cataract care, is noted, and any sub-optimal visual recovery in uneventful cataract surgery is evaluated for a possible correlation with the USG B scan finding.

The goal of this study is to document posterior segment findings in patients with dense cataract using USG B-scan examination and to look into the prevalence of various pathologies in cataract patients.

Study Objectives

i. To assess the findings of the USG B- scan in cataract patients with grade 4 media clarity.

ii. To look for a possible correlation between postoperative day 1 vision and USG B-scan findings.

INCLUSION CRITERIA:

1. Patients aged 18 and above are eligible.
2. Patients with advanced (mature, hyper mature) and dense cataracts (other cataracts obscuring post-segment visualization) have grade 4 media clarity.

EXCLUSION CRITERIA:

1) Patients with corneal opacity
2) Traumatic and developmental cataracts
3) Patients with previous intraocular surgery
4) any known retinal pathology.
5) in cases of vitreous haemorrhage or retinal detachment, if detected during screening.
6) Patients suffering from active adnexal infections

RESULTS

89 cases were evaluated out of which 47 were males and 42 were females. Detailed history was taken and 5 patients had a history of trauma and 2 patient had corneal opacity. These patients were excluded from the study. The other 82 cases 42 female and 40 males were included from the study 69% of the subjects had normal B-scan in the operating eye. Among the patients with abnormal findings on B-scan, the most common findings were vitreous detachment (12.19%), followed by asteroid hyalosis (10.97%) .Post operative vision was recorded and 10 patients were recorded to have less than 6/60 vision that is low vision

CONCLUSION

The diagnostic ophthalmic USG B-scan (8–10 MHz) is one of the quickest and simplest methods for posterior segment evaluation. It is non-invasive, cost-effective, and easily available. B scan can detect posterior segment pathologies like the status of vitreous, the position and extent of any intraocular lesion, the condition of the retina and macula, the motility of the contents of globe, and the relation between the vitreous and the retina. A preoperative USG B-scan in cases of dense media opacity enables the ophthalmologist to plan surgery, take measures to combat predictable complications, and counsel the patient regarding the visual prognosis.

Key words: B-scan; Ocular Ultrasonography, Posterior Segment, Retinal Detachment, Posterior Vitreous Detachment, Asteroid Hyalosis

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INTRODUCTION

Among all the treatable causes of blindness, cataract is the primary cause. It accounts for approximately 33% of treatable blindness. In the South Asian region, which includes India, 51% of blindness is due to cataracts. [1]

Cataract surgery is a common surgery worldwide. In developing countries like India, many patients come up with mature cataracts. A mature cataract is a totally opaque lens that causes severe visual loss. Managing mature cataracts is difficult due to the increased risk of surgical complications and the need for good surgical skills. [2,3] A dense advanced cataract makes it impossible to visualise the posterior region during preoperative evaluation, which makes it challenging for the surgeon to predict the visual prognosis following surgery. Mature cataracts thus provide substantial challenges during preoperative assessment. [4]

Preoperative assessment of cataract patients includes a complete examination of the eye by a combination of clinical inspection, slit lamp examination, and posterior segment examination by an ophthalmoscopic examination[1,5]. In the presence of a mature cataract, ophthalmoscopic examination is not possible due to obstruction of the light pathway by the lens' opacity. Various alternative techniques for the evaluation of the posterior segment include assessment by B-scan, macular function tests, and various electrophysiological techniques. Among the posterior segment pathologies, the common pathologies are vitreous detachment, retinal detachment, vitreous haemorrhage, chorioretinal thickening, choroidal thickening, and posterior staphyloma, etc. [4]

The B-scan is a noninvasive method to detect posterior segment pathologies. It is one of the quickest and simplest methods, is cost-effective, and is easily available. Ultrasound is an acoustic wave made up of partials oscillating in a medium. The human eye, with its superficial position and its fluid-filled structures, is ideally suited for examination by USG. [6] The frequency used in the diagnostic ultrasound for the posterior segment is 8–10 MHz.

B scan enables the ophthalmologist to plan surgery and take measures to combat various predictable complications. [2][5] Also it is useful to know postoperative visual prognosis.

Other methods of preoperative assessment in such cases include macular function tests and various electrophysiological techniques. However, it has limited accuracy and the results are limited to the prediction of postoperative visual function.

In our hospital there is a large pool of mature cataract patients. Bscan examination is helpful in diagnosis of various posterior segment pathologies like vitreous detachment, retinal detachment, vitreous hemorrhage, chorioretinal thickening, choroidal thickening, and posterior staphyloma etc which will help in explaining visual prognosis to the patients.The present study is conducted to identify posterior segment pathologies in patients of mature cataract using B-scan and to study the prevalence of various posterior segment pathologies among patients with mature cataract.

AIMS AND OBJECTIVES

1. To evaluate the USG-B scan findings of cataract patients with media clarity of grade 4.

2. To look for possible correlation between post operative day 1 vision and USG- B scan findings.

REVIEW OF LITERATURE

The eye readily lends itself to ultrasonic investigation due to its superficial location and fluid filled structures. Such examination is indicated when opaque media prevents the visualization of the posterior segment of the eye or if any orbital pathology is suspected. Ultrasonic frequencies suitable for ophthalmology examination range between 5 and 20 MHz. Three different 'pulse echo' techniques are described, namely A-scan, B-scan and C-scan; the last technique is employed only in orbital diagnosis.

In 1889, **Dr. Curie** described the piezoelectric phenomenon. [7,8] At the same time, Prof. Langevin and his colleagues demonstrated the transmission of ultrasound through the water as well as the use of ultrasound for submarine detection. [9]

The A-scan technique was first reported in the 1950s [10]. The transducer is generally placed directly on the eye, and the echoes are recorded as spikes. The height achieved by the spike gives the amplitude of the echo, while on the horizontal axis, the position of the spike gives the measure of the arrival time of the echo at the transducer. However, the amplitudes of echoes from large interfaces, such as membranes, are highly dependent on inclination, making the diagnosis of pathology difficult by A-scan alone.

In 1955, **Venysek I Serle and Pacak** used sonar for the first time in Ophthalmology for identifying IOFB, mainly the ones not detected by other clinical means.

The use of the B-scan technique in ophthalmology was first described by **Baum and Greenwood (1958)**. They described that, in B-scan echoes are plotted as dots instead of spikes, and the brightness of the dot indicates the size of the received echo. The transducer is moved to several positions above the eye, and a whole series of intensity registrations are plotted. The resulting B-scan is comparable to a histological section through the eye and orbit. (11)

In the early 1960s, **Jansson and associates** in Sweden, used ultrasound to measure the distances between structures in the eye.(12)(13)

The **Society International for Diagnostic Ultrasound in Ophthalmology (SIDUO)** was later established in 1964.(14)

In B-scan, the focused, single-element ultrasound transducer is mechanically pivoted while pulsing and receiving at a series of angular increments to sweep out a sector. A two-dimensional image of the eye can be generated by setting pixel brightness at each position proportional to echo amplitude based on the orientation of the probe at each moment and the range of each echo. In the 1960s, **Coleman et al. and Purne** separately developed immersion B-scan systems in which a normal saline bath was formed between the eye and the transducer, allowing the transducer to be mechanically moved without touching the eye to produce B-scans. The first enclosed B-scan probe for contact ultrasound examination of the eye was developed by

Holasek et al. Shortly thereafter, Bronson developed a contact B-scan that became the prototype of clinical systems to follow. [15]

In 1974, **J. Poujol** used contact B mode with logarithmic amplification. C.[16]

Restori et al. first used a scan to diagnose optic nerve damage in 1977.[17]

In Ethiopia, **Haile M. and Mengistu Z.** used B-scan ultrasonography on 318 eyes of 298 patients. 90% of the eyes had opaque media, with 66% having posterior pole abnormalities. The most common finding was retinal detachment (39%), followed by vitreous opacities (31%), abnormal eyeball size (12%), IOFB (4%), posterior staphyloma (3%), and RD with vitreous opacities (2%). Out of these, thirty patients were evaluated for proptosis and twenty-eight patients had abnormal orbital tissue, like solid and cystic tissue patterns. 32% of patients had abnormal orbital studies, followed by thyroid orbitopathy (25%), nonspecific (7%), and infiltrative (4%) tissue patterns. This proved that the B-scan was an important diagnostic tool for detecting and analysing orbital and ocular pathologies [18].

Anteby II, Blumenthal EZ, Zamir E, and Waindim P published the article" The role of preoperative ultrasonography for patients with dense cataracts " in1998. In this study, the authors retrospectively studied 509 patients referred for routine ultrasound examination of the globe due to dense cataracts. Posterior segment pathologies were noted in 19.6% of the patients on B-scan. The most common pathologies were posterior staphyloma accounting to 7.2% of the patients; followed by retinal detachment (4.5%) and VH (2.5%). One patient with a large choroidal malignant melanoma was identified. Patients with a history of ocular trauma had a slightly higher prevalence of posterior segment pathologies than non-traumatic cataract patients (29.6% versus 19.0%, respectively; P =.1). The traumatic cataract subgroup had an elevated rate of retinal detachment (14.8% compared with 3.9%), but this difference was not statistical significance. It was determined that diseases that may affect the surgical approach and the postoperative visual prognosis for patients with thick cataracts can be found with a preoperative ultrasonography assessment. [19]

In 2001, **Ukponmwan CU et al.** in Benin City, Nigeria, performed B-scans on 39 patients from March 1999 to February 2000. The study had 25 males and fourteen females. The correlation between the B-scan ultrasound diagnosis and the clinical diagnosis was 92.3%.

On the B-scan, RD was detected in 21 patients, which was the most common finding. The study concluded that VH, IOFB, mucocele, orbital tumors, and trauma can also be detected using B-scan. This study concluded that the B scan is a safe, non-invasive, and inexpensive tool for detecting various ocular and orbital pathologies. Following the study, the use of a B-scan was strongly advised in Nigeria.[20]

In 2003, **Sen KK, Parihar J, Saini M, and Moorthy RS** published a sonographic study of 164 patients (328 eyes) for the evaluation of retinal disorders, especially in patients with opaque ocular media. Out of the 164 patients examined, 39 had retinal disorders diagnosed on B-mode ultrasonography (23.78%). B-mode ultrasonography showed a sensitivity of 100% and a specificity of 98.7%. 164 patients were investigated, and 34 of them (21.34%) had RD, which can have both traumatic and non-traumatic origins. 14% of the cases with RD were non-traumatic, and they were seen in cataract cases that were selected for posterior segment examination. Five patients had retinoblastoma, while 11 patients had both RD and vitreous haemorrhage.In this study, the benefits of using ocular ultrasonography (B-mode) to evaluate retinal disorders, particularly in patients with opaque ocular media, are described in detail. The eye can be examined quickly, cheaply, safely, and with confidence using B-mode sonography. When fundoscopy is not possible due to opaque ocular media, this modality has been found to have extremely high sensitivity and specificity in detecting ocular pathologies. As a result, it is of great value to the eye surgeon for a preoperative assessment of the posterior segment.. [(21)]

In 2006, **Bello TO and Adeoti CO** published a study on ultrasonic assessment in pre-operative cataract patients. It was a 12-month prospective study of patients with advanced cataracts with 116 eyes of 80 patients. One hundred and ten eyes (94.8%) had a normal posterior segment. Total retinal detachment was noted in 3 eyes (2.59%), a left partial retinal detachment was observed in 1 eye (0.87%), and total retinal detachment in conjunction with vitreous hemorrhage was noted in 2 eyes in a single patient (1.72%). It was concluded that patients with dense cataracts should undergo an ultrasound-guided posterior segment examination as part of their preoperative evaluation before surgery.[(22)]

Salman A, Parmar P, Vanila CG, Thomas PA, and Jesudasan CA conducted a study in a South Indian tertiary care hospital in 2006 to determine the utility of ultrasonography before surgery in eyes with advanced cataracts. In this prospective study conducted over 6 months, all eyes with dense cataracts precluding visualization of the fundus underwent assessment with ultrasound. Ultrasound evidence of posterior segment pathology was found in 36 of the 418 eyes examined, or 8.6%. Detachment of the retina (17 eyes; The most prevalent abnormality found was 4.1 percent. A high incidence of abnormal ultrasound scans was associated with diabetes mellitus.. In ocular features, posterior synechiae (OR = 20.2, P = 0.000), iris coloboma (OR = 34.6, P = 0.000), inaccurate projection 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 associated with a high incidence of posterior segment pathology. Only four eyes (1.5%) without these features had abnormal posterior segments on ultrasonography. In conclusion, the presence of certain ocular features is associated with a high incidence of posterior segment abnormalities. Patients with these features should be referred for preoperative ultrasonographic evaluation. [23]

Adebayo SB et al. showed that B-scan ultrasound findings were useful in diagnosing posterior segment pathologies in 95% of patients, thereby aiding in the operative management of ocular and orbital diseases with media opacity. [24]

Ejaz AJ et al. (2007) conducted a B-Scan on 463 patients at the Madina Medical Center, University of Faisalabad, over a period of 1 year. The study included 73.2% male and 26.8% female patients. Among these, 19.4% had medial opacity due to dense cataracts, 13% had a vitreous hemorrhage, 14% had RD.0.4% of patients had choroidal thickening, and 0.4% had PHPV. The study concluded that B-scan proved to be a valuable diagnostic modality in opaque media and had remarkable prognostic importance. (25)

Mendes MH, Betinjane AJ, Cavalcante Ade S, Cheng CT, Kara-José N. did a study on ultrasonographic findings in patients with cataracts in 2009. 289 eyes from 215 patients were examined, and findings in the posterior pole and vitreous cavity were found in 77.5 percent of the eyes.. A posterior vitreous detachment was observed in 47.4% of the eyes. The remaining 30.1% presented with eye diseases that could result in reduced visual function after surgery. Diffuse vitreous opacity and retinal detachment , 12.1% and 9.3% respectively were the most common eye conditions observed.It was concluded that the ultrasonographic examination revealed the eyes with ocular abnormalities along with cataracts as the cause of poor vision, thereby indicating the importance of its use during ocular evaluation. (26)

Zafar D. et al. published in 2008 a study where he had performed 320 B-scans over a period of 3 years, from February 2002 to March 2005. Patients were chosen from the outpatient department, Ziauddin Medical University's Department of Ophthalmology, and Dr. Akil Bin Abdul Kadir Welfare Eye Hospital in Karachi, Sindh, Pakistan.The goal was to find out how useful B-scan ultrasonography is and how frequently ophthalmology patients asked for an ultrasound B-scan exam. The study concluded that diagnostic ultrasonography proved to be a very helpful method for medical diagnosis in ophthalmology. Opacity in the vitreous was the most common problem, followed by a retinal detachment, for which ultrasound was advised. (27)

Lorenzo-Carrero J, et al. (2009) demonstrated that B-scan ultrasonography had 96% sensitivity and 98% specificity for detecting retinal tears. The estimated pretest probability of positive B-scan ultrasonography was 10.8%, and the estimated post-test probability was 89%.(28)

Ahmed J et al. (2009) used B scans in patients with vitreous opacities to detect vitreoretinal pathologies. The study was conducted for 1 year in the Department of Ophthalmology at Isra University and Hospital. 68 patients out of 73 patients had vitreous opacities and poor to no retinal visualization. This study proved that the B Scan is a useful diagnostic tool in both the detection and evaluation of vitreo-retinal pathologies in patients with vitreous cavity opacities. (29)

In a study by **Jammal HM, Khader Y, Shawer R, Al Bdour M**.titled "Posterior segment causes of reduced visual acuity after phacoemulsification in eyes with cataract and obscured fundus view"(2012) a total of 201 eyes of 179 patients were studied. They had a preoperative VA of </= 6/60. Preoperative ocular co-morbidity

was present in 31 eyes (15.5%). Intraoperative complications occurred in 20 eyes (10%). Postoperative complications developed in 34 eyes (17.0%). One month postoperatively, 175 eyes (87.1%) achieved a BCVA of 6/12; whereas 26 eyes (12.9%) achieved a BCVA of 6/18.Age-related macular disease accounted for 38.5 percent of the 26 eyes with reduced VA, followed by diabetic maculopathy in 23.1 percent of the eyes. In 10 of the 26 eyes, similar fundus pathology was observed prior to surgery in the fellow fundus. Thus highlighting the role of posterior segment evaluation in cataract patients with obscured fundus view. (30)

Hafiz MA et al (2011) carried out a Study in Radiology and Eye Departments of BVH Bahawalpur. 50 cases diagnosed with orbital masses on B-scan. 24 (48.0%) cases were females and 26 (52.0%) were males. The study sought to determine whether sonography is useful in the detection of eye and orbital disease and to optimize sonographic visualization of the eye in all patients with suspected eye problems.

The goal was to find out abnormal findings on B-scan in possible orbital mass instances. This study found that orbital masses could be accurately identified using a B-scan. On B-scan, various diseases showed up in various ways. When identifying orbital masses such vascular tumours, solid and cystic tumours, neurogenic tumours, and inflammatory diseases, the B-Scan is a useful tool. (31)

In 2012, **Jasmin Zvornicanin , Vahid Jusufovic , Emir Cabric et al** reported the Significance of Ultrasonography in the Evaluation of Vitreo-retinal Pathologies. They reported that 39.7% of eyes had dense media out of which, 14.4% had due to dense cataracts and (25.3% eyes due to different vitreous opacities. While 60.3% of eyes had good or partial posterior eye segment visualization. Among these, 45.9% of eyes had proliferative vitreoretinopathy and 37.7% of eyes had a tractional retinal detachment. Ultrasonography confirmed suspected diagnosis and operative management plan in 82.2% of eyes, subclassified previously established diagnosis in 13% of eyes, and helped further operative planning and established initial management plan in 4.8% of eyes. It was concluded that sonography is an indispensable diagnostic tool for eyes with poor posterior segment visualization(32)

Dessì G, Lahuerta EF, Puce FG, Mendoza LH, Stefanini T, Rosenberg I, Del Prato A, Perinetti M, Villa A. presented a study “the role of B-scan ocular ultrasound as an adjuvant for the clinical assessment of eyeball diseases” in 2014. The examinations were performed in B-mode and in color Doppler imaging by a dedicated radiologist. Also, a dedicated ophthalmic scanner was used in some examinations. A linear high-frequency (7.5–13.0 MHz) transducer was used. It was found that disorders of the posterior layers of the eyeball were the diseases detected with greater frequency (20 cases). B scan provides good sensitivity and specificity so B-mode echography is required every time the vitreous chamber and the retina are not visible; for example, in cases of very mature cataracts, hemovitreous, corneal opacities, blood or pus in the anterior chamber (traumas, herpes keratitis, endophthalmitis) and lesions of uncertain nature for a differential diagnosis. [33]

Jatin garg et al. : A prospective study was carried out in Rewa city from January 2013 to December 2013 which included 153 eyes. In this study, the patients were divided into traumatic eyes (13.93%) and atraumatic eyes (86.07%), and the posterior segment abnormalities on B-scan were noted in patients having dense cataracts. Posterior segment abnormalities on B-scan were seen more in traumatic cases. Among the atraumatic group, the most common B-scan finding was PVD(2.94%) followed by RD(2.20%). Among the traumatic group, the prevalence of VH and RD was the same (22.72%). They concluded that B-Scan ultrasonography should be performed routinely in the pre-operative assessment of cataract patients to diagnose pathologies of the posterior segment. This helps in planning the surgical strategy which eventually influences the visual prognosis of patients following cataract surgery. [34]

Agrawal R, Ahirwal S. A study of the role of B scans ultrasound in posterior segment pathology of the eye. This prospective study was conducted from October 2013 to October 2014. Patients referred by the Department of Ophthalmology for high-resolution ultrasonography were taken into the study. A clinical ocular assessment and a B scan Ultrasonography assessment was performed on 50 patients. 22% of patients were in the 5th decade. Loss of vision and redness of the eye were the leading symptoms. The maximum no. of ocular abnormalities studied were Vitreous (40.2%) followed by Retina (25.77%). Also Among vitreous abnormalities, Vitreous hemorrhage was the most common accounting for 56.41% of cases followed by vitreous detachment (33.33%), and the vitreous band was found in 10.25% of cases. Retinal detachment was the common retinal abnormality detected (41.5%), while retinoblastoma was seen in 5.66 % of cases. 81.81% of eyes had cataracts among total lens abnormalities followed by dislocation of the lens (18.18% among lens abnormalities). Choroidal abnormalities were choroidal detachment (80%) and choroidal hemorrhage in 20%. It was concluded that B-scan is a very efficient tool for diagnosing various ocular abnormalities. B-scan can categorize the lesions in the posterior chamber and can localize the lesion (IR-2)[(5)]

Surekha V. Bangal, Akshay J. Bhandari, Fuzail Siddhiqui presented a study in 2016 titled "Pattern of Ocular Pathologies Diagnosed with B-scan Ultrasonography in a Hospital in Rural India". A prospective observational study was conducted in their hospital over a period of 2 years. A total of 100 patients were included. Statistical Analysis was done by Chi-square test. In this study of 100 cases, the majority of the cases (57%) were above 40 years of age. There were 54 (54%) male patients and 46 (46%) female patients. Ocular trauma resulting in cataract formation was the most often reported indication for ophthalmic B-scan USG, occurring in 45 cases. In 45 (97.83%) incidences, there were 46 cases of ocular trauma and traumatic cataract, which was significantly more than other pathology (P 0.05). In 3 (3%) cases, IOFBs were identified. Conclusion: B-scan USG is an excellent, reliable, and relatively inexpensive noninvasive radiological screening test for accurately predicting a spectrum of ocular disorders in both visible and opaque media. [35]

Awadia Gareeballah et al. published a study in 2018 in the Sudanese Journal of Ophthalmology based on a single-center, cross-sectional study conducted at Al Walidain Eye Hospital in Khartoum State (Omdurman). The study was conducted from February 2017 to July 2017, and it included one hundred and two pro-operative cataract cases. The average age was 61 + 13.87 years. It has been noted that gender is a significant factor influencing the incidence of cataracts (P = 0.04). Females were more affected by nuclear and secondary cataracts, while nuclear and traumatic cataracts were more common in males. Among the entire study group, the nuclear type of cataract was seen to be more common. After the B-scan was performed, it was revealed that 77.5% of the patients did not have any abnormal B-scan findings. Cataracts appeared as an ovoid echogenic mass on sonography. The most common finding among patients was PVD, which was 19.6%. Other abnormalities seen on the B-scan were VH, edema, and staphyloma. [36]

Dr. Jitendra Kumar, Dr. Puneet Kumar Jaisal, and Dr. Amarnath Ram conducted a study of the role of the B-scan in evaluating posterior segment pathology of the eye. This Observational Prospective Study of B-scan was conducted over a period of one year from September 2017 to August 2018,180 patients with known and suspicious posterior segment pathology were evaluated. Out of 180 patients, 123 (68%) were males, and 57 (32%) -were females. The patients had an age range between 6 months to 70 years. The majority of patients (34.4%) were in the age group ≥61 years. The most common indication of ocular sonography in our study was opaque media due to lenticular opacity (52.5%). Ninety four patients (52.2%) did not demonstrate any posterior segment pathology on B-scan echography. In our investigation, vitreous haemorrhage (VH), which occurred in 17.7% of cases, and retinal detachment (RD) in combination with vitreous abnormalities, which occurred in 8.9% of cases, were the two most frequent posterior segment lesions. Other B-scan findings were isolated retinal detachment group, retinoblastoma, total choroidal detachment, endophthalmitis, dislocated PCIOL, and phthisis bulbi. [40]

In a prospective study carried out by **Skandesh B M, Mohan Kumar**, and colleagues from May 2017 to May 2018, the importance of high-resolution B-scan in detecting lesions of posterior segment lesions was demonstrated. Contact b-scan was used in all patients and sonographic findings were co-related with the final diagnosis to confirm the accuracy.

In this study, 91 patients including fifty-two males and thirty-nine females were taken. Sixty-six patients had opaque media while twenty-five patients had clear media. 18.6% of patients had normal B-scan. Among the abnormal B-scans, VH was reported in 35 (31%) patients, PVD in 32(28.3%), vitreous floaters in 10(8.8%) patients, asteroid hyalinosis in one patient, and PHPV in one patient. RD was the most common finding among retinal pathologies detected in B-scan. 1 case of RD was missed and 1 case of choroidal thickening was missed on HRBU when a diagnosis was confirmed clinically. It was proved from this study that B-scan provides a non-ionizing, cost-effective, non-invasive technique which is a vital part of an ophthalmologist's diagnostic armamentarium, especially with cases of opaque ocular media. (37)

A cross-sectional study was done in August 2019 by **Dr. Mohd. Mobin et al** study the importance of B-scan in the preoperative evaluation to detect pathologies in patients with dense cataracts. The study was conducted over a period of 2 years. In the study, 625 eyes were taken out of 510 eyes. The most common age group was 61- 70 years of age (40.2%). 61.8% of patients were males. Risk factors with abnormal B-scan findings were compared and the most common risk factor was found to be Diabetes mellitus. Among 30 diabetics 13 patients had abnormal B-scans. Other risk factors were elevated IOP, posterior synechiae, keratic precipitates, and small cornea. The ocular B Scan demonstrated that RD (4%) was the most common finding and followed by PVD(2%). (38)

A study was conducted in 2021 by **Ngweme G, Bambi MTN, Lutete LF, Kilangalanga NJ, Hopkins A, Stachs O, Guthoff RF, Stahnke T,** to look into the use of the diagnostic Bscan ultrasonography. Between 2006 - 2019, it was organized in Kinshasa. Two groups comprising three hundred twenty-three patients each were formed. There were 262 patients in Group 1 with dense cataracts. 61 participants in

Group 2 who already had ocular adnexal pathologies were examined using a B-scan ultrasound.

There were 437 thoroughly examined eyes in group 1. 91.08% eyes showed normal B scan finding.Out of the 39 eyes showing abnormal findings, 13 patients were identified with RD (2.97%) and 15 patients had detached posterior hyaloid membrane (3.43%)

In the second group, 61 patients were examined . Surgery was performed in 20 of them for palliative care, mucoceles drainage, tumour removal, and biopsy. It was determined that there was a limited need for routine B-scan exams in patients with dense cataracts.(39)

Kim MS, Moon JH, Lee MW, Cho KH. "Analysis of postoperative intraocular pathologies in patients with mature cataracts" was a retrospective study published in 2022, January. It reviewed the medical records of 115 eyes of 115 patients diagnosed with dense cataracts who underwent surgery between January 2018 and August 2021. 37 eyes had introcular pathologies (32.2%). Drusen (6.1%), myopia degeneration (5.2%), and diabetic retinopathy (4.3%) were the most prevalent abnormalities. In adult cataract eyes, posterior segment pathology was linked to intraocular pathology in the other eye. The researchers did not discover anything remarkable about the prevalence of each intraocular pathology identified post mature cataract surgery. This research demonstrates clinicians with clinically relevant data that they can use to describe the intr-operative risk of eyes with posterior segment pathology in dense cataract patients. (40)

In a study done by **Rajarathna Hegde et al** in July'22, 74 eyes had Normal B-scan valuesThe most common other finding was Vitreous degeneration (35.32%), Posterior vitreous detachment (21.74%) Posterior staphyloma (0.54%), Retinal detachment (1.08%), Vitreous hemorrhage (0.54%) and Asteroid hyalinosis (0.54%) (41)

In a study done by **Joyese ekeme et al.** in June'22, the most common sonographic findings were retinal detachment (44, 35.2%), vitreous hemorrhage (39, 31.2%), traumatic lens dislocation (11%), intraocular tumors (6%), choroidal detachment (6%) posterior vitreous detachment(6%), contracted globe(5%), intraocular foreign body(4%), Phthisis bulbi (2%) (42)

Physics of Ultrasound

Sound is a vibration that propagates as an audible mechanical wave of pressure and displacement, through a medium such as air or water. Audible sound is

in the frequency of 20~20,000 Hz.

An ultrasound has 3 components

1. Wavelength
2. Frequency
3. Amplitude

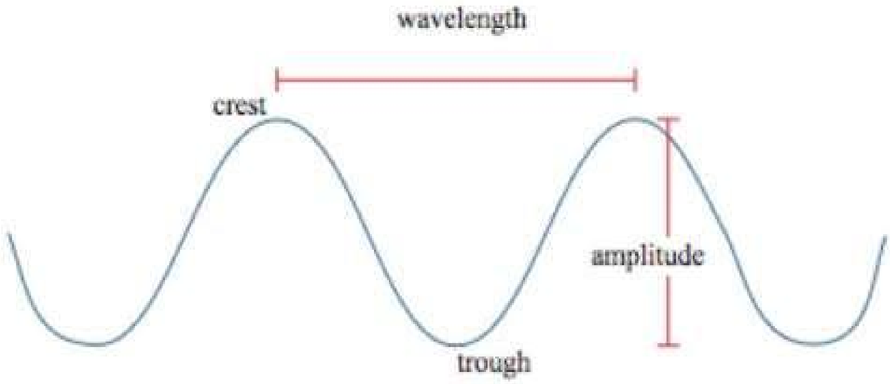

Figure 1 : Features of a Wave

1. Wavelength: The distance(mm) between successive crests of a wave. It is the distance covered to complete on cycle.
2. Amplitude: It is the maximum extent of a vibration or oscillation measured from the position of equilibrium.
3. Frequency: number of oscillations of the particles in the medium per second as they vibrate about their state of rests. The unit of frequency is cycle per second or Hertz (Hz).

4. Velocity: Velocity is the speed of sound propagation. It is expressed in meters per second.

Velocity = Wavelength x Frequency The velocity of an ultrasound wave depends mainly on the medium through which it passes

Table 1: Velocity of sound in human body tissues

Substance	**Velocity at 25oC (m/sec)**
Soft tissue	1540
Brain	1541
Liver	1549
Kidney	1561
Blood	1570
Muscle	1585
Lens of eye	1620
Skull	4080

Table 2: Velocity of sound in Ocular Media

Human Tissue	Velocity (m/sec)
Cornea	1555
lens	1641
Aqueous humour	1532
Vitreous humour	1532
sclera	1651
Extraocular muscles	1631

Ultrasonic Systems

The principle of ultrasonic investigation in ophthalmology is to use a transducer probe to transmit a sequence of ultrasonic pulses to the eye. These pulses are then echoed back by any solid or semisolid surface inside the eye and picked up by the same probe, rectified, amplified, and detected by an oscilloscope. The pulse- echo technique is used for this.. [43,44]

In ophthalmology, the two most commonly used ultrasonic imaging modalities are A-mode and B-mode. Each presents anatomic information in a distinctive display format. A-mode refers to a graphic display of echo amplitude as a function of distance along one line of sight, or vector. A-mode was the first display mode to be used in ophthalmology [10].

It is used in characterization of tissues such as intraocular tumors and vitreous hemorrhage. It is also widely used in biometric applications, such as axial length measurement and corneal pachymetry.

A- and B-mode systems may be incorporated in two seperate instruments or may be combined in a single instrument.

A-mode displays may be generated using a special purpose A-mode transducer or may be generated from individual vectors comprising a B-mode display.

ULTRASOUND SYSTEM COMPONENTS

The system contains the following:

1. Transducer/probe
2. Servo (for B-mode systems)
3. Pulser
4. Receiver
5. Scan converter and display

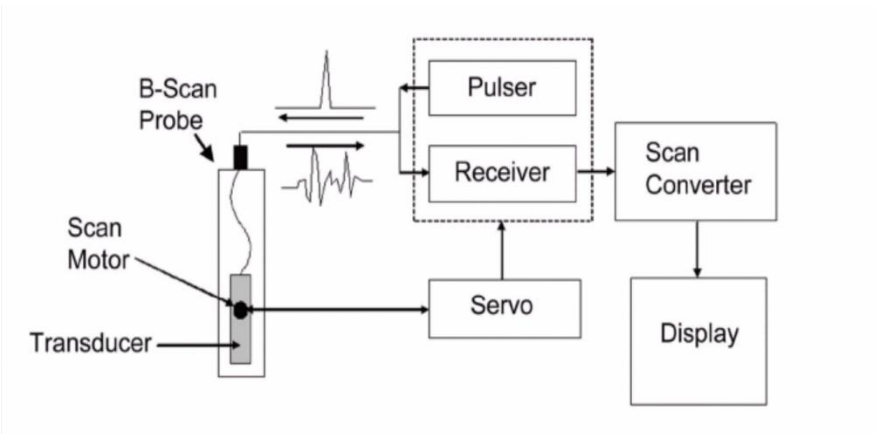

Figure: 2 Schematic representing electronic components comprising a B-mode system.

PROBE/TRANSDUCER:

The main component is the piezoelectric element made of quartz or ceramic crystal. The crystal is located near the face of the probe. When electrical energy stimulates the crystal, it undergoes mechanical vibration. This vibration causes a longitudinal ultrasound wave to be propagated through the medium. To allow the transducer time to receive returning echoes, a pause of several microseconds occurs. As this returning energy strikes the crystal, it creates another mechanical vibration which in turn produces an electrical signal that is transmitted to the receiver and the display screen. This process is repeated a thousand or more times per sec to produce a real-time display.

Another component of importance in the ultrasound probe is the damping material. This is attached to the back of the crystal and it usually consists of metal powder mixed with plastic or epoxy which serves to limit the vibrations of the crystal that produce the pulses of ultrasonic energy. As a result, the pulse is shortened. This in addition to the frequency directly relates to the axial resolution of the ultrasound system. Shorter pulses result in better axial resolution.The sound beam has two zones, the near field and the far field. The near field

is the portion of the sound beam located closest to the probe face. The far field is the portion of the sound beam that is located beyond the near field. When the echo source is located within the near field, the resolution of echoes is maximum.(45)

Gain/Sensitivity

The gain or sensitivity setting of the instrument adjusts the amplification of the echo signals. Decibels (dB) is the measurement used. The higher the gain level, the greater the ability of the instrument to display weaker echoes. To allow greater amplification of more distant, weaker echoes than of stronger echoes originating close to the transducer, many instruments incorporate Time Gain Compensation (TGC). (43)

SERVO

The servo controls the motion of the transducer within the probe. It registers the orientation of the transducer at each moment. The servo controls a motor incorporated within the probe, and, as the transducer moves, the servo continually monitors its position. Each scan frame consists of a fixed number of vectors (typically 256) that are evenly spaced within each scan frame. As the motor sweeps the transducer, the servo monitors its position and issues signals to the pulser and other components such that pulse/echo vectors are acquired at appropriate positions(46)

PULSER

The pulsar repeatedly sends short voltage pulses which shock excites the transducer. Each shock excitation generates ultrasonic pulse. The PRF is low which allows all returning echoes to be received by the transducer before the next pulse is generated. The distance till the optic chiasm is considered as the longest distance to be covered is 6 centimetres

Hence the travel time both ways for an acoustic pulse can be calculated as = 2 × 0.06 meters ÷ 1,540 m/sec = 0.078 m sec. Usually a 1 Kilo hertz pulse repetition frequency is used. This suggests that pulses are generated at 1-msec intervals, which is longer time than the time for pulse and its echo travel from the deepest portion of the orbit. The nature of the ultrasonic pulse is an important factor in determining the attainable resolution of the ultrasound system. The significant characteristics of the pulse are form, duration, and amplitude. A- or B-mode imaging most commonly has negative spike; other modes, such as monocycle (a single sine-wave) are used rarely.

Long excitation pulses corresponds to long ultrasonic pulses and further poor axial resolution. Thus, negative spike impulses are normally designed to be of short duration.

RECEIVER[45]

The echoes from ocular/orbital structures impinge upon the transducer and excite the transducer. This will generate small voltages that are proportional to echo amplitude. These generated voltages are processed by the amplifier and other electronics before they are displayed in a useful format. The electronic receiver will amplify minute voltages generated by the transducer.

In ophthalmic ultrasound instruments, one of three different types of amplification is generally used:

I. linear

II. logarithmic

III. S-shaped

Gains of 40 dB or more are required to raise the amplitudes of these signals from their initially low levels (e.g., 1 millivolt) to levels that are compatible with display requirements.

The functions of the receiver are :

1. It acts as a limiter of pulses to prevent damage from the high voltage excitation spike produced by the pulser,
2. A pre-amplifier for low-noise (which sometimes is incorporated in the probe) to boost gain
3. Time-gain control (TGC), compression, noise reject, and envelope detection

An important prime factor regarding receiver gain is saturation. This is encountered when the amplified pulse reaches the maximum level that an amplifier can supply. This occurs when the input signal is too large or if the gain is too high, This may eliminate clinically significant information. (Figure 2.4). Saturation is seen picked up by the amplifier at the beginning of an A- or B-mode display. The majority of scan systems do not display the "main bang," which creates a dead space in front of the transducer and cancels out echoes from nearby objects.

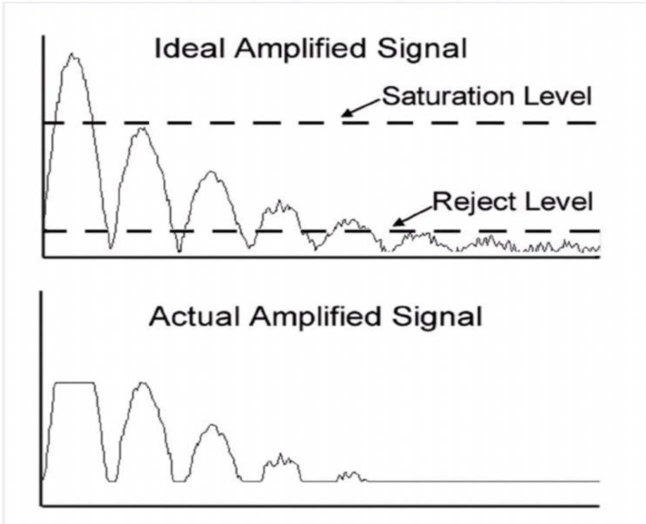

Figure 3 :The effects of saturation and reject on high- and low-level signals.

SCAN CONVERTER AND DISPLAY

For the digital display of ultrasound data, an ADC -Analogue to digital converter a type of scan converter, is used. This holds a series of memory locations that map directly to the pixels of the digital display. The main role is transforming B-mode data into an image form in digital memory. This includes remapping every pixel that is displayed into specific scan vectors and ranges. This will ensure that proper image geometry is obtained. With successive scan frames, the memory of the scan converter is overwritten and the new information is displayed on the monitor. When the operator pushes the freeze frame button of the scanner, the last update of the scan converter memory is continually shown, hence allowing a prolonged view of the particular frames. Sometimes systems' cine-loop feature is also included in which several successive frames are displayed and stored in digital memory.

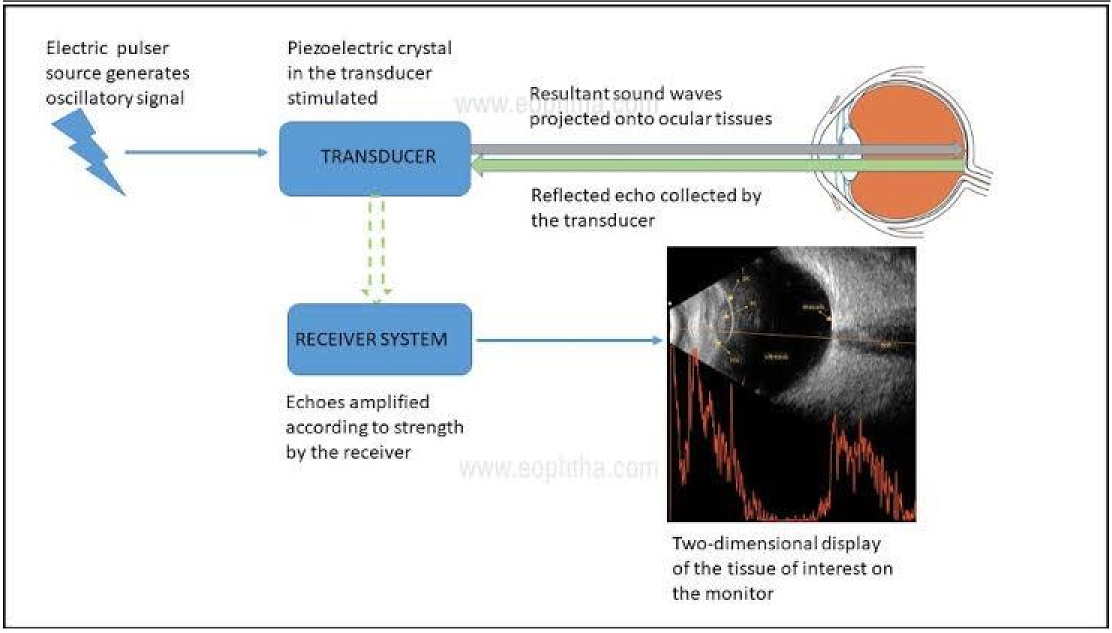

FIGURE 4: B-scan model

Standardization:

Standardization refers to adjusting the instrument to obtain a pattern in conformity with that obtained with other instruments.

Internal standardization is provided by the manufacturers, which accurately sets certain parameters that may affect the processing of the signal

External standardization is done by the examiner. It establishes tissue sensitivity and calibrates the electronic scale.

Tissue Sensitivity

Tissue sensitivity is the sensitivity setting of each unit probe combination needed for a standardized examination. This is provided by the manufacturer. It can be cross-checked by the examiner with a model tissue. This model tissue consists of a specific number of glass beads distributed evenly in a resin matrix.

1. hold the probe perpendicular to the surface of the tissue model using methylcellulose or water as a coupling agent.
2. Sensitivity is usually kept at 80 dB which is its maximum setting.
3. The system sensitivity is decreased gradually until the angle kappa becomes 450. This system sensitivity is called tissue sensitivity

MODES OF DISPLAY

1. A Mode: Amplitude-modulated display (Time amplitude system)

A-scan is a one-dimensional acoustic display.

Echos are shown as vertical spikes from the baseline. The spacing of these spikes depends on the time required for the sound beam to reach a given interface and the echo to return to the probe. Then the time between two consecutive echo spikes is then converted into distance. [47]

2. B Mode: Brightness-modulated scan

B-scan produces a two-dimensional acoustic section by using both the vertical and horizontal dimensions of the screen to indicate configuration and

location.

It employs a transducer probe which is enclosed in a

handheld container. These devices have

The resolution capacity is 0.4mm axially and 1mm laterally.

Interpretation of a B-scan depends on:

1)Real-time

The movement of the globe and the vitreous is visualized The images formed are visualized at 32 frames/second.

This type of ultrasonography can be used to visualize detached retinas or mobile vitreous for vitreoretinal surgery.

Grayscale

It produces two dimensional images. Strong echoes are displayed brightly at high instrument gain and remain visible even on reducing the gain. Weaker echoes are seen as lighter shades of gray that disappear reducing the gain. Comparing echo strengths is the basis for qualitative tissue analysis.

Three-Dimensional Analysis

When evaluating difficult retinal detachments, intraocular tumours, and orbital tumours before surgery, a three-dimensional picture is crucial because it gives crucial anatomical information.[48]

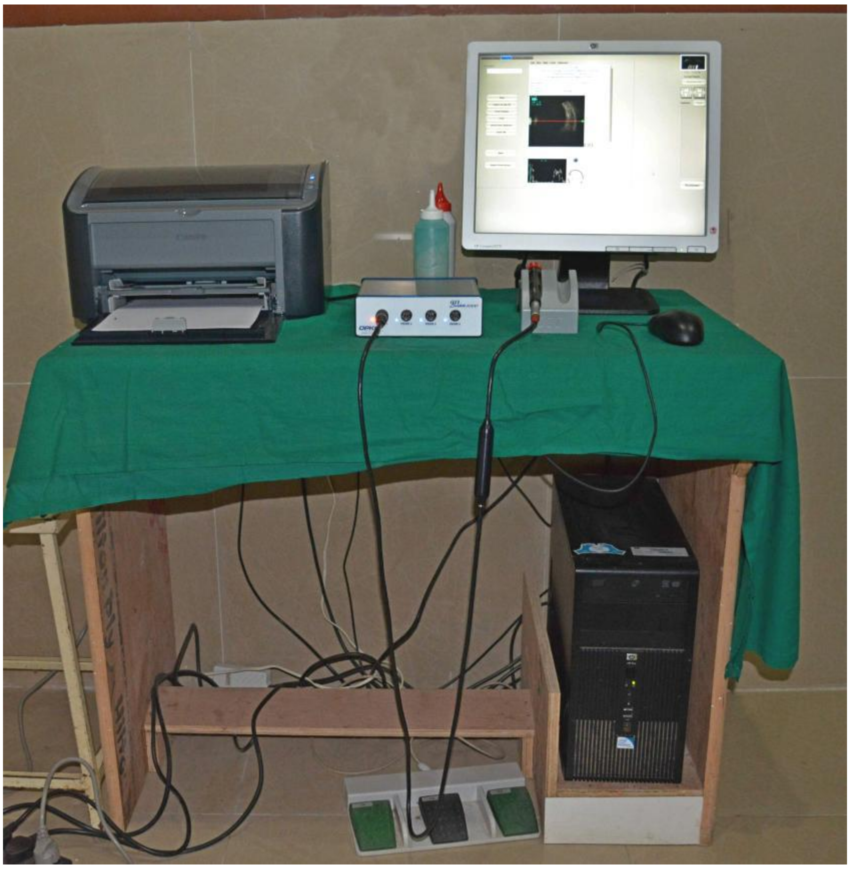

FIGURE 5: B-scan instrument and system

EXAMINATION TECHNIQUE

B scan can be used as contact and emersion B scan

Contact B scan: Contact B-scan with cross vector is used for the assessment of the posterior segment of the eye i.e. vitreoretinal status, macula, ONH (Optic Nerve Head), and anterior two-thirds of the orbital cavity for any space-occupying lesion or oculo-orbital trauma. The initial examination is performed at maximum system sensitivity.

The subject is asked to close the eyelids and 2% methylcellulose is applied over the probe.The B-scan probe has a white mark on one side.

The probe is held vertically in front of the corneal apex, with the marker on the probe positioned to the right or left to obtain a horizontal scan. A gentle up-and-down translation of the probe is used to highlight interfaces on the screen showing a horizontal scan through the visual axis. At this stage, it is important not to tilt the probe in any axes. [49]

B scan examination sections:

a)Axial

b)Transverse

c)Longitudinal

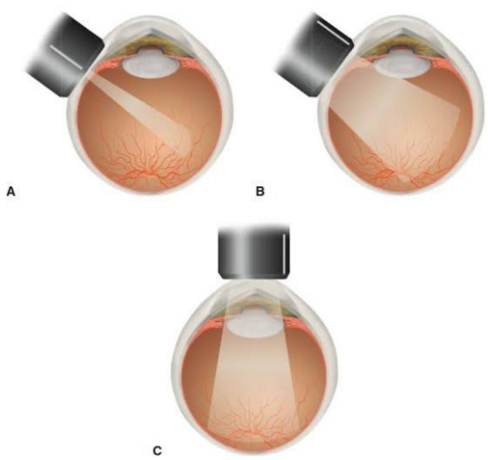

Figure 6: **Positions of probe to obtian images on B-scan:**

A: Transverse section

B: Longitudinal section

C: Axial scan

During the procedure the probe is moved from limbus to fornix in different clock hour meridians and the picture seen is of diagonally opposite meridian as follows:

TABLE 3: PROBE POSITION AND THE AREA SCREENED

Clock hour- Probe position	Clock area-Area screened
3-Limbus	9-Posterior
3-Equator	9-Equator
3-Fornix	9-Anterior
6-Limbus	12-Posterior
6-Equator	12-Equator
6-Fornix	12-Anterior

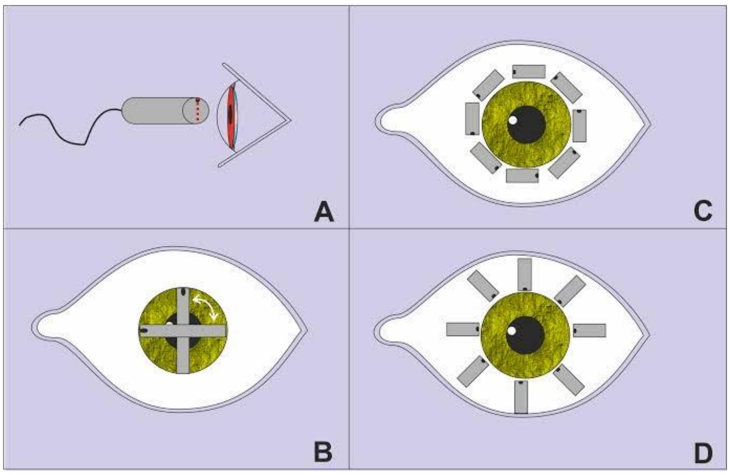

FIGURE 7: CLOCK HOUR PROBE POSITION

The probe can be moved anteroposteriorly as well as sideways. The patient is instructed to fix the gaze so that the probe is perpendicular to the area being examined.

The four standard Bscan probe locations for macular screening are horizontal axial, vertical transverse, longitudinal, and vertical macula approaches. These positions allow for perpendicular sound beam exposure to the macula..

Axial section: It is instructed to the patient to focus on the primary gaze. The probe is axially positioned on the globe. Axial-horizontal, axial-vertical, and axial oblique images are produced based on the marker's position in relation to the clock hour. These sections demonstrate lesions at the posterior pole and the optic nerve head. The axial scan detects disorders of the macula, tenon’s space, and the optic nerve marked attenuation because the lens in the path of the sound beam is seen in the picture may Hence it is not preferred to measure the thickness of the macula. To avoid this, the probe is placed at the limbus The lens is 9.00- Posterior position in the right eye and 3.00 Posterior position in the left eye.

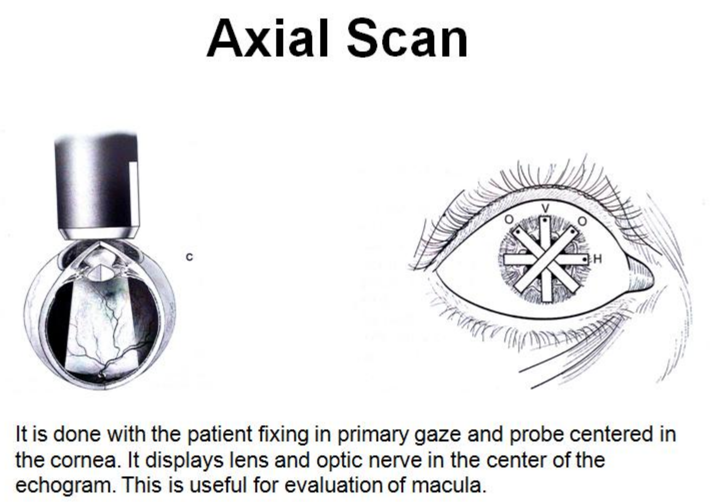

FIGURE 8: DEMONSTRATION OF AXIAL SCAN ON B-SCAN

Para-axial scans

Mark on the probe is kept parallel to the limbus. The probe is then shifted from the limbus to the fornix and sideways. This gives the lateral extent of the lesion.

In ophthalmic ultrasonography, the optic disc is used as the reference center of the posterior segment. [45])

The transverse scan shows the lateral extent of the posterior segment pathology

and is used in evaluating [45]

A. RD

B. Circumferential extent of ocular masses.

These scans can bypass the attenuation created by the crystalline lens. Therefore compared to axial scans, there is a better resolution of ocular structures. Here the patient's gaze should be directed approximately 30^0 in the direction of the area which is to be examined. The probe tip is placed on the conjunctiva 180° away from the area to be examined.

Transverse section:

Mark on the probe is kept parallel to the limbus. The probe is then shifted from the limbus to the fornix and sideways. This gives the lateral extent of the lesion.

In ophthalmic ultrasonography, the optic disc is used as the reference center of the posterior segment. [43]

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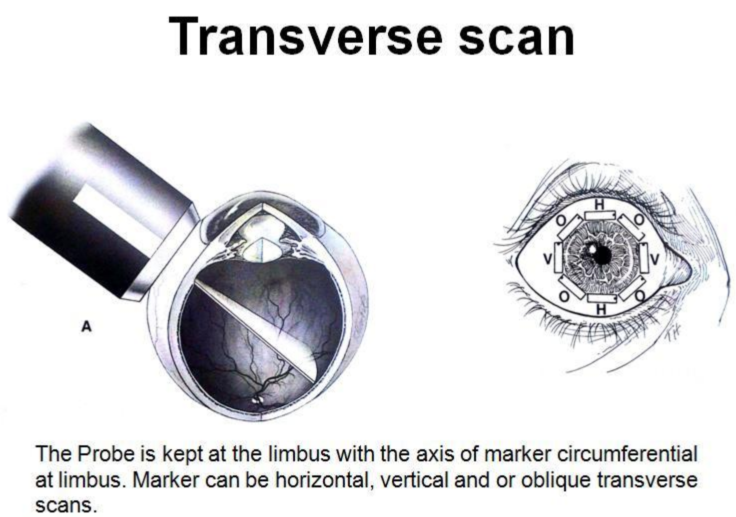
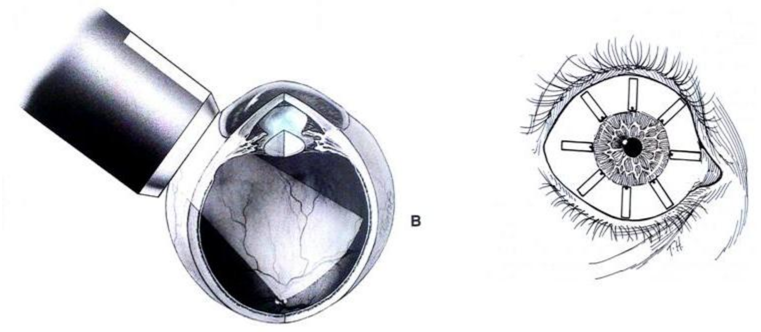


FIGURE 9: DEMONSTRATION OF TREANSVERSE SCAN ON B-SCAN

Longitudinal scan



The marker is perpendicular to the limbus.

FIGURE 10: DEMONSTRATION OF LONGITUDINAL SCAN ON B-SCAN

Longitudinal section: The mark is kept at right angle to the limbus to determine the antero-posterior limit of the lesion

With contact type of scanning there is a dead zone of about 7.5 mm adjacent to the probe, so that the lesions in this region are missed. To visualize this area, one can keep the probe on the opposite side at right angle or use immersion scan technique.

Longitudinal scan is helpfull in evaluation:

i. Membranes for insertion into the optic disc or adjacent to the optic disc.
ii. Localization of small fundus abnormalities such as a retinal tear or a focal tractional retinal detachment
iii. Evaluation of the macula.

Topographic examination performed using the B-scan probe throws light on the

1. Size, shape and contour of the mass lesion
2. Membranous opacity
3. Discrete vitreous opacities (single or multiple)
4. Abnormalities in globe contour

Kinetic Echography is required to determine the tissue mobility and vascularity in the lesion. For this, at times colour Doppler instruments are used in conjunction with B-scan.

Quantitative Echography is performed with A-scan more objectively and precisely in contrast to B-scan which yields semi-quantitative information. The knowledge obtained regarding reflectivity, internal structure, and sound attenuation helps in its differentiation from similar lesions. The various reflectivity categories are as follows[45]:

TABLE 4: VARIOUS REFLECTIVITY CATEGORIES

Category	Spike height, %
Extremely low	0-5
Low	5-40
Medium	40-60
Medium-high	60-80
High	80-100

DIAGNOSTIC PARAMETRES

If a lesion is detected further examination is carried to find out the following characteristics of the lesion :

a**. Location** : Eight quadrant is identified in relation to optical disc (Superior, sup-nasal, nasal, inf-nasal inferior, inf-temp, temporal, sup-temp). the proximity of the lesion to the optic nerve head is also evaluated.

b**. Shape :** Once the lesion is localized its shape is evaluated. Eg. Solid lesions may be dome shaped or mushroom shaped. In the presence of a membranous lesion (RD PVD) its attachments is noted.

c**. Consistency** : An intraocular lesion can be either solid or nor solid in consistency. During ocular movement all echogenic opacities will move. However immediately afterwards solid structure stop moving, where as non solid lesions will continue to move (after movement). ―After movements‖ are seen as undulations of the membrane when the patient moves the eye.

TABLE 5 Diagnostic Parameters

	Gross Morphologic Features
1	Location
2	Size
3	Outline/Contour/Shape
4	Associated Ocular Changes
5	Changes with Time
	Fine Morphologic Features
1	Boundary Layer Properties
2	Acoustic Impedance
3	Roughness of Surface
4	Internal Tissue Properties
5	Internal Texture (Homogeneous or Heterogeneous)
6	Type of Internal Structural Elements
7	Spatial Distribution of Internal Structural Elements
8	Acoustic Absorption

Internal tissue properties affect how ultrasonic waves are transmitted and reflected. There are fewer internal reflective surfaces in tissues with a homogeneous structure (such as the lens, the optic nerve, or solid tumours like malignant melanoma), which gives the tissue a "cystic" or sonolucent hollow or hypoechoic look on B-scans.

This image stands in stark contrast to the dense, speckled hyperechoic appearance caused by reflections from interior characteristics of heterogeneous structures, such as those found in hemangiomas, angiomas, and vitreous haemorrhages.

The type and distribution of the interior structural elements determines the amplitude and geographical distributions of the echo in these heterogeneous systems (e.g., blood vessels, calcific deposits, or necrotic regions). Additionally, the decrease in echo amplitude with depth indicates that the ultrasound beam has been attenuated by absorption and scattering. (In homogenous structures, attenuation may appear as "shadowing" or blockage of detail in tissues further posterior. Specific ocular tissues and pathologic states can be identified using the attenuation of ultrasonic frequency-related scattering in tissue.

ARTIFACTS ENCOUNTERED IN OCULAR ULTRASONOGRAPHY

Artifacts are seen during ultrasonic evaluation of the eye and knowing their appearance will avoid interpretation.

Artifacts may be classified into four groups:

(a) electronic artifacts,

(b) reduplication echoes,

(c) refraction artifacts,

(d) absorption effects.

ELECTRONIC ARTIFACTS

Arises from unsatisfactory electronic processing of the ultrasonic echoes. A typical artifact is referred to as snow, which is produced by background noise (“grass” on the A-scan trace) and resembles interference on a television screen. Background noise can usually be eliminated electronically by requiring incoming echo-generated energy to exceed a certain threshold level before triggering the B-scan presentation, thus rejecting low-amplitude background noise. This problem is rare with modern B-scan ultrasound systems.

REDUPLICATION ECHOES

Reduplication echoes (also known as multiple echoes) occur commonly. These types of echoes have been studied by Kossoff [(55)]. They appear along the axes of the cornea and lens. High amplitude echoes are reflected back to the transducer when it is aligned perpendicular to the tissue surface. When they are reflected back from the transducer, it produces what is called a reduplication echo.

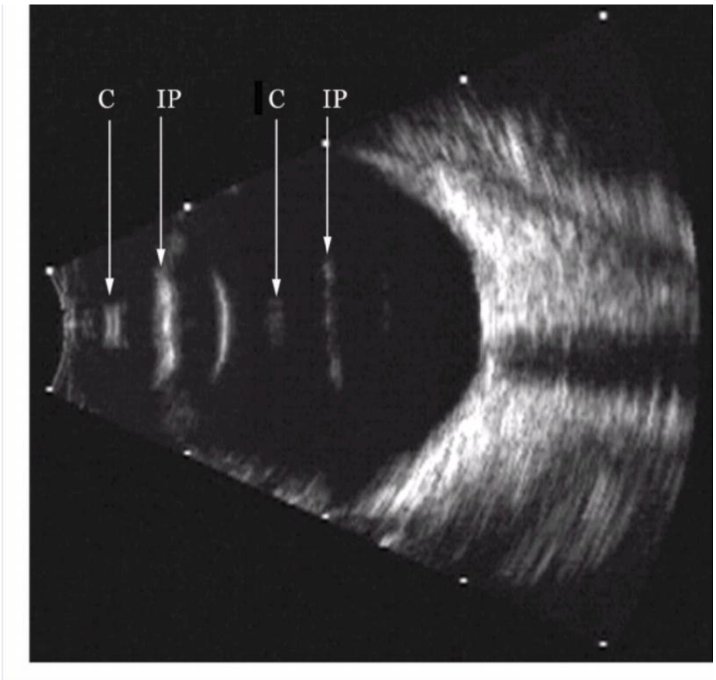


FIGURE 11: The arrows show reduplication artifacts from the anterior segment as a result of high gain used in the electronic display. C: cornea; IP: iris plane.

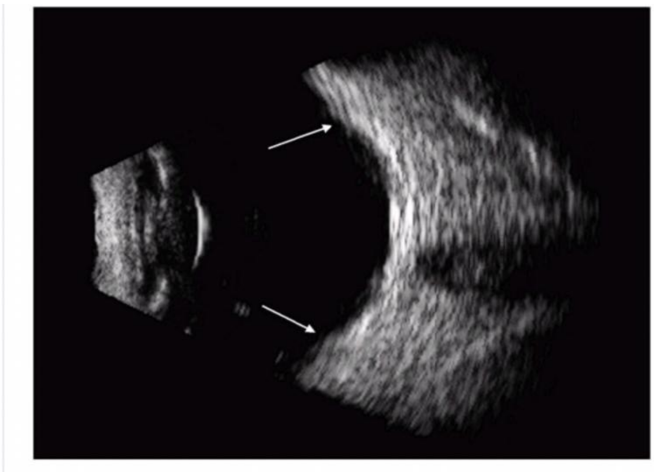


Figure 12: . Baum's bumps on a contact B-scan

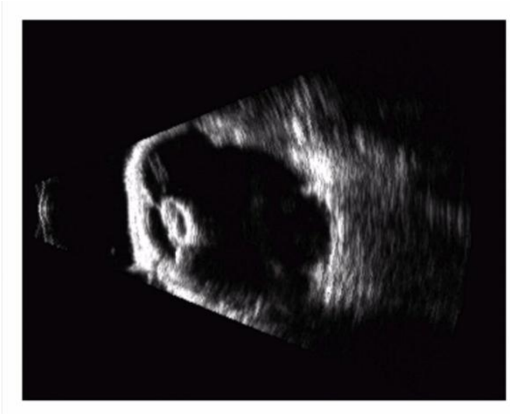


Figure 13: Artifacts posterior to a calcific cataract are seen, producing distortion and hypoechoic areas caused by deflection and absorption of the ultrasound beam.

REFRACTION ARTIFACTS

These artefacts are related to the position of the transducer.These are produced within ocular tissue by the refraction of ultrasound. On B-scan, the relatively high lenticular propagation velocity can produce apparent abnormalities of the posterior pole that resemble tumour formations or thickening of the choroid (Figure 3.22). Purnell hasreferred to these refraction abnormalities of the posterior pole as "Baum's bumps," because they were originally described by Baum.

The sonographic appearances of the eye and orbit closely resemble the normal anatomical structures.

Normal appearance of ocular structures:

The eye is the easiest object to visualize within the orbit, as its fluid content and

The superficial position makes it ideal for ultrasound examination.

Lens: It is seen as an oval, highly reflective structure. Intralenticular echoes vary from

Depending on the amount of cataract visible, they can range from non-reflective to highly reflective.

Vitreous: This is acoustically clear, but older specimens may exhibit low reflective echoes.people.

Retina, choroid and sclera: The three are combined to form a single, highly reflecting structure.

On ultrasonic imaging, the retina's anterior surface can be seen clearly, whereas the posterior surface blends into the choroid. Near the optic nerve's entry, the thickness is 0.4 mm; at the ora serrata, it is 0.1 mm.

The choroid: This thin erectile vascular layer, which may be up to 1 mm thick,

The sclera: This layer displays a higher reflectivity than the choroid.

<u>Normal appearance of extraocular structures:</u>

The optic nerve is seen as a hypoechoic band starting at the scleral zone and extending posteriorly and medially.

Extra-ocular muscles: They appear as fusiform hypoechoic spaces between retrobulbar fat and occasional low-amplitude echoes from the orbital wall.

Retrobulbar fat: It is hyperechoic compared to other structures and any lesion within The orbit is well demarcated by this fat.

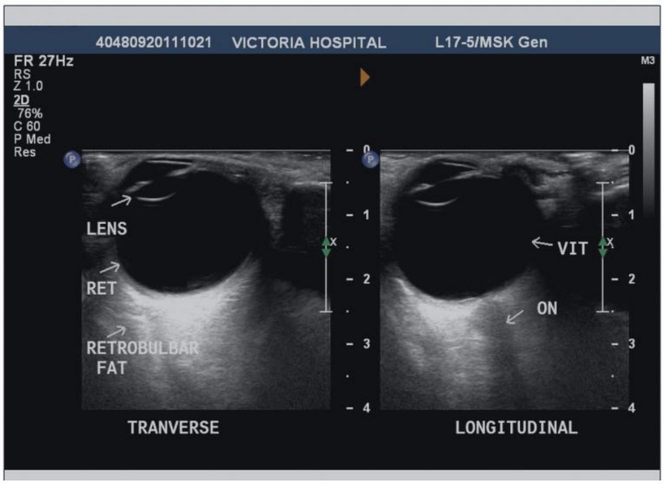


Figure 14: Transverse and longitudinal scan through normal orbit depicting various structures as an noted

Sonographic lesions of common intraocular conditions:

1) Vitreous floaters:

- They are seen as less brightness echo dots usually in the mid or posterior vitreous cavity. They are mobile on B-scan.
- Larged globes size usually show vitreous floaters.

2) Vitreous haemorrhage

- It can be fresh or resolving
- It may be associated with membrane formation and can cause tractional Retinal detachment.
- To visualise vitreous heamorrhage, the gain has to be increased by 10 db
- They appear as multiple fine echo opacities dusting the vitreous body
- The are limited to the posterior border of vitreous
- VH is attached to the retinal surface but might get detached

3) Asteroid Hyalosis

- They are calcium crystals embedded in an amorphous matrix
- They appear on B-scan as echodense dots of medium to high reflectivity
- multiple, densely packed, homogeneously distributed echodense dots of medium size
- Seen at the core of vitreous body.

4) Posterior vitreous detachment (PVD):

- PVD is due to trauma, VH or old age
- An echogenic membrane concentric to the globe, infront of the retinochoroidoscleral complex with clear subvitreal space.

- ❖ It may be small, interrupted, peripheral or continuous and total.
- ❖ The echo density increases if it has a linning of red blood cells

5) Retinal detachment:

Means separation of neurosensory retina from the pigmentary retina. It may be total/subtotal, localized/peripheral or fresh/old with proliferative vitreoretinopathy (PVR) changes.On B scan, it appears as echogenic dense membrane, biconvex or biconcave with 100% attachment at the optic nerve head (ONH)

6) Scleral Ex-plants are used in rhegmatogenous RD surgeries where buckle or sponge is applied to indent the globe. On B scan they appear as echogenic spots with the globe indentation towards the vitreous body and echolucent spot (shadowing) behind the scleral ex-plant. The ex-plant shows high reflectivity on A scan. Silicone buckle is less echo dense in comparison to the sponge.

7) Vitreous expanders like silicone oil or perfluorocarbons may be seen in operated RD cases. Emulsified silicone oil produces marked sound attenuation hindering the visualization of posterior segment.(Figure 14) It also results in a larger vitreous cavity which is relatively echo free. Perfluorocarbons on the other hand show multiple, highly reflective liquid bubbles in the posterior vitreous.

Methodology

Present study was a hospital based conducted in Ophthalmology department of a tertiary eye care hospital after obtaining approval from institutional ethical committee.

STUDY DESIGN:

Observational cross sectional study.

DURATION OF STUDY:

From January 2021 to December 2022

SAMPLE SIZE:

Sample size of 90 patients at 10% absolute error and confidence interval of 95%. Based on the prevalence of 37% B-scan effective in mature and hyper mature cataract.[59]

INCLUSION CRITERIA:

Patients of age group 18 and above years having mature and hyper mature cataract with grade 4 media clarity.

EXCLUSION CRITERIA:

- Patients having corneal pathology (such as dystrophy or opacity)
- Patients having active adnexal infection.
- Patients with immediately preceding trauma. (last 1 year)
- Traumatic and Developmental cataract.
- Patients with previous intra ocular surgery.
- Any known Retinal pathology.
- Those who do not give consent for study.

METHOD OF COLLECTION OF DATA:

- All patients of mature cataract as per inclusion criteria and after excluding those falling under exclusion criteria were included in study.

- informed consent was obtained from all patients and the purpose of study was explained to them. Demographic data of all patients like age and sex were noted.
- Detailed clinical history including history of present illness was noted.
- Visual acuity assessment was done by using Snellen chart for distant vision and near vision charts for near vision.
- Complete anterior segment examination was done by slit lamp bio microscope which also included examination after dilatation of pupil.
- Examination of posterior segment was done by 90D lens on slit lamp bimicroscope and by 20D on indirect ophthalmoscope.
- Based on 90D lens on slit lamp bimicroscope examination Grades of media clarity were taken as the following:

  1+ = hazy nerve fiber layer

  2+ = disc and vessels hazy

  3+ = only disc visible

  4+ = disc not visible [51]
- In patients having mature and hyper mature cataract or cataract with grade 4 media clarity Posterior segment pathologies were evaluated with B-scan ultrasonography. Patients were made to lie supine on examination table. They were evaluated using ultrasound machine equipped with a real time linear high frequency probe of 10 MHZ. The probe was placed on closed lids after application of coupling gel. B scan pictures were obtained in axial, transverse

and longitudinal sections. The lowest possible decibel gain consistent with the maintenance of adequate intensity was used for optimum results.

- Significant posterior segment pathologies are defined as those conditions likely to affect the visual outcomes. A quantitative measurement of the various posterior segment pathologies was made in these patients based on the b-scan findings.
- Post surgery visual acuity of all patients was recorded on Snellen's distant vision chart on day 1.

STATISTICAL METHODS USED FOR THIS STUDY

Data will be entered into Microsoft excel data sheet and will be analysed using SPSS 22 version software

Examination Techniques –

Examination was done with patient sitting or supine and the eye lids closed. Coupling gel of 2% methyl cellulose was applied on the probe of B-scan. The probe was gently placed over the closed eyelid without any local anesthesia and examination was done in the following different orientations.

B-scan Probe Orientation:

1. Transverse scan – The Probe is kept at the limbus with the axis of marker circumferential at limbus. The area of the marker is displayed in the upper part of screen. This can be horizontal, vertical and or oblique transverse scans.
2. Longitudinal scan – The marker is perpendicular to the limbus.
3. Axial Scan - Is done with the patient fixing in primary gaze and probe centered in the cornea. It displays lens and optic nerve in the center of the echogram. This is useful for evaluation of macula.

RESULTS

TABLE 6 Age Distribution Among Study population

AGE GROUP	FREQUENCY
<50	4
51-60	12
61-70	36
70-80	25
>80	5

GRAPH 1: Age Distribution Among Study population

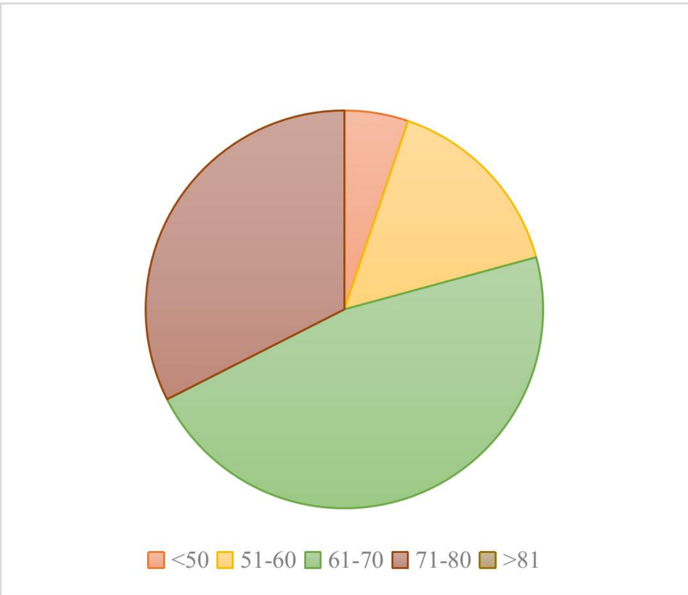


TABLE 7 Gender Distribution Among Study population

GENDER	FREQUENCY
Male	40
Female	42
Total	82

GRAPH 2 Gender Distribution Among Study population

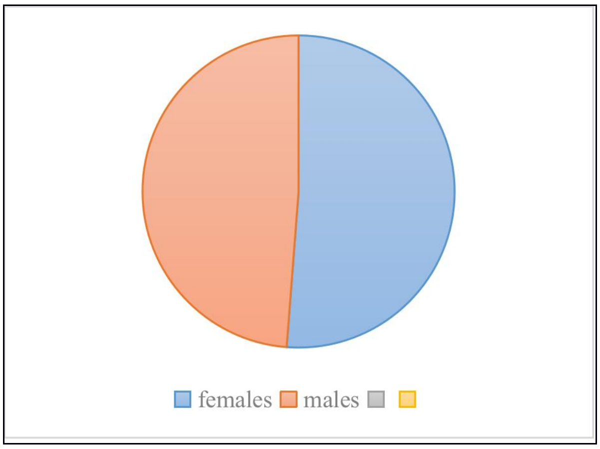


TABLE 8:Distribution of study population according to laterality

EYE HAVING DENSE CATARACT	FREQUENCY
Right	43
Left	32
Both	7

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GRAPH 3:DISTRIBUTION OF STUDY POPULATION ACCORDING TO THE LATERALITY

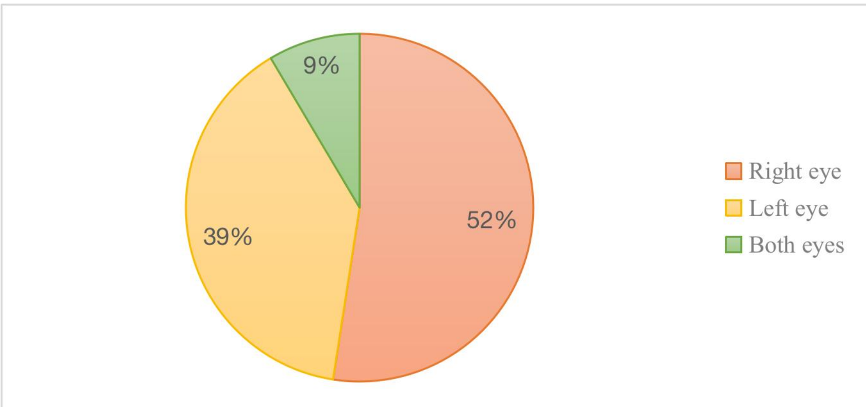


TABLE 9:Distributed of the study population according to the eye operated

EYE OPERATED	FREQUENCY	PERCENTAGE
Right	45	54.87
Left	35	42.68

GRAPH 4 :DISTRIBUTION OF STUDY POPULATION ACCORDING TO THE EYE OPERATED

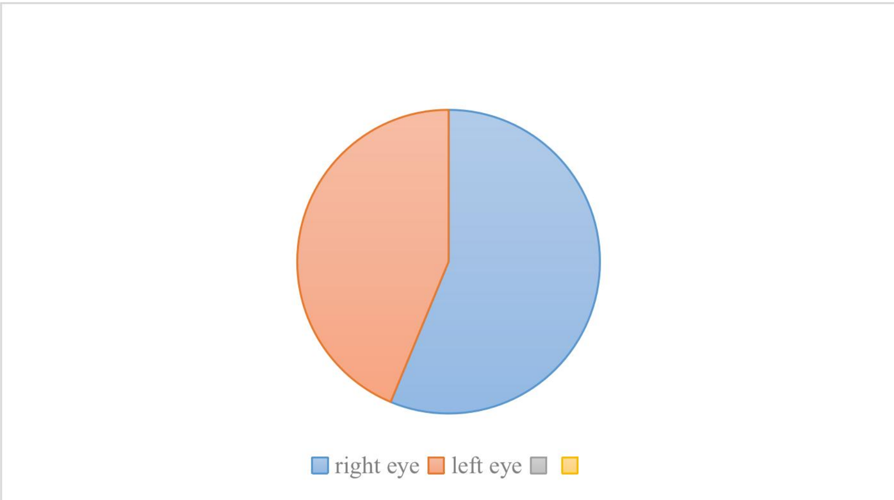


TABLE 10 Distribution of study population according to visual acuity

TABLE 10.1 Right Pre-Operative Visual acuity

Category	Visual acuity	Frequency	Percentage
1	6/6 to 6/60	18	21.95
2	<6/60 to Finger counting 1 m	14	17.07
3	<Finger counting 1m and Hand movements +	4	4.87
4	Perception of light+ Projection of rays accurate in all 4 quadrants	46	56.09
	Total	82	100

GRAPH 5: Right Pre-Operative Visual acuity

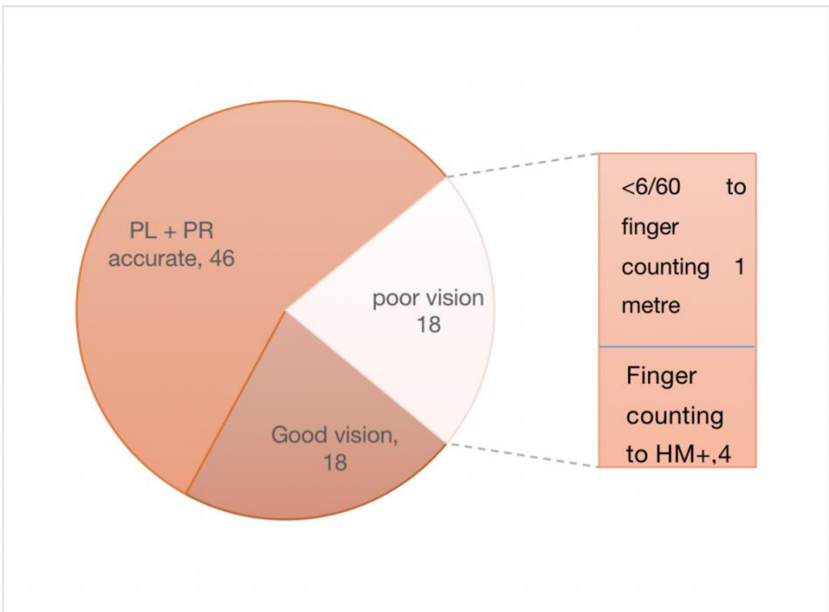


TABLE 10.2 Left eye Pre-Operative Visual acuity

Category	Visual acuity	Frequency	Percentage
1	6/6 to 6/60	25	30.48
2	<6/60 to Finger counting 1 m	18	21.95
3	<Finger counting 1m and Hand movements +	10	12.19
4	Perception of light+ Projection of rays accurate in all 4 quadrants	29	35.36
	Total	82	100

GRAPH 6: Left eye Pre-Operative Visual acuity

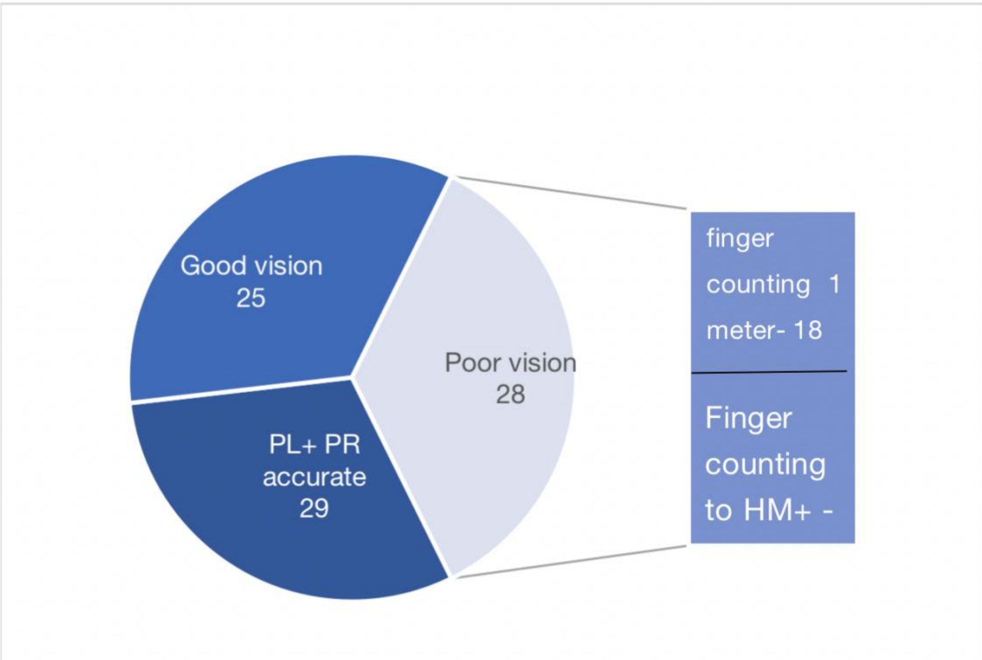


TABLE 11 Distribution Of Study Population According To The Grading Of Cataract

TABLE 11.1 Cataract Grading in right eye among study population

Cataract grading	Frequency	Percent
SMC	40	48.8
SHMC	6	7.3
SIMC	19	23.2
NS4	1	1.2
PSEUDOPHAKIA	16	19.5
Total	82	100.0

GRAPH 7: Cataract grading in right eye among study population

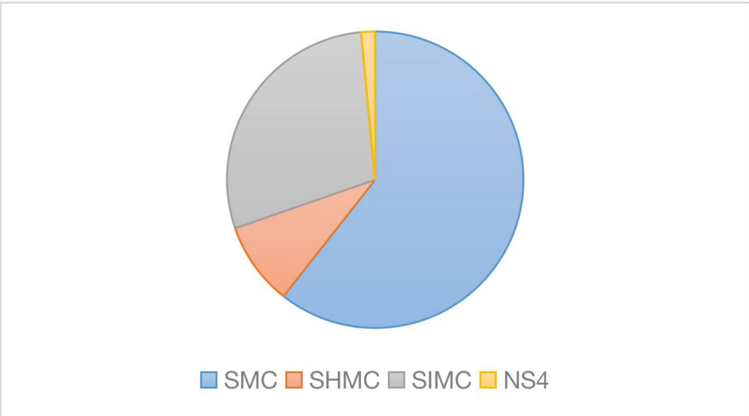


Table 11.2 Left Eye Cataract Grading in study population

	Frequency	Percent
SMC	26	31.7
SHMC	10	12.19
SIMC	28	34.14
NS4	4	4.87
pseudo	13	15.85
NS5	1	1.21
Total	82	100.0

GRAPH 8 :Cataract grading in left eye

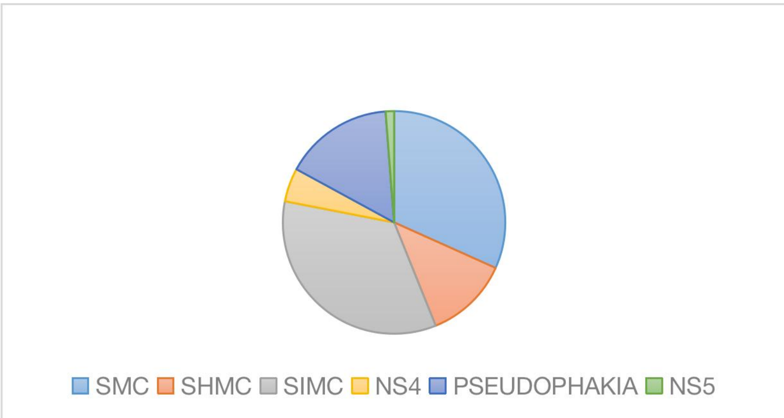


Table 12 Distribution among study population according to the type of mature cataract

Cataract type	Frequency	Percentage
Nuclear cataract	5	6.81
Mature cataract	64	75
Hyper mature cataract	14	18.18
Total	82	

GRAPH 9: Distribution among study population according to the type of mature cataract

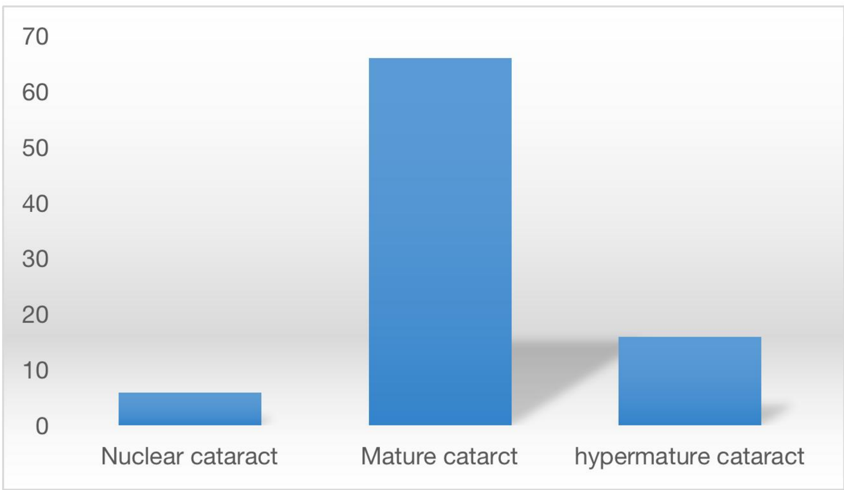
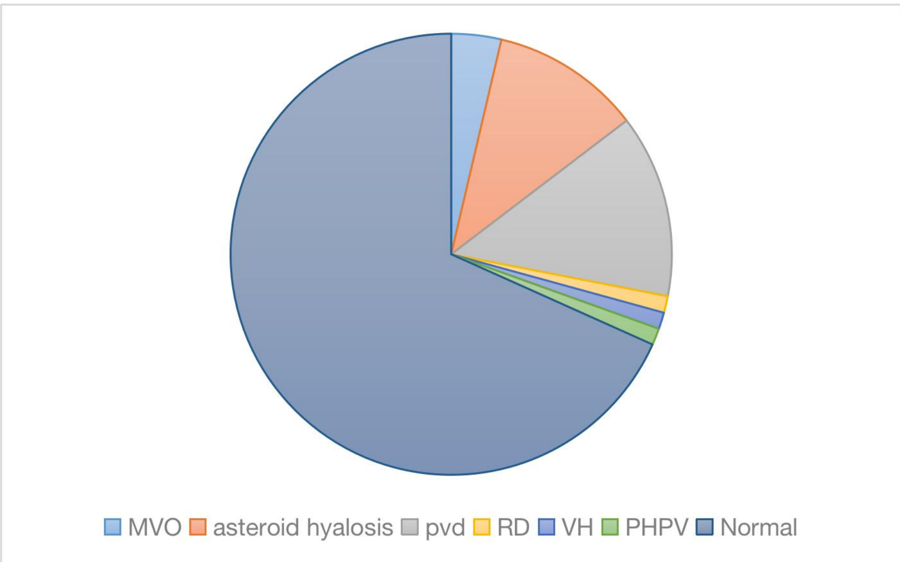


TABLE 13 Distribution among study population according to the B scan finding in the operating eye

B SCAN	Frequency	percentage
normal	58	70.73
Asteroid hyalosis	9	10.97
Vitreous detachment	10	12.19
Retinal detachment	1	1.21
Mid vitreous Opacity	3	3.6
PHPV	1	1.21

GRAPH 10 Distribution among study population according to the B scan finding in the operating eye



GRAPH 10 :Distribution among study population with B scan finding in the operating eye

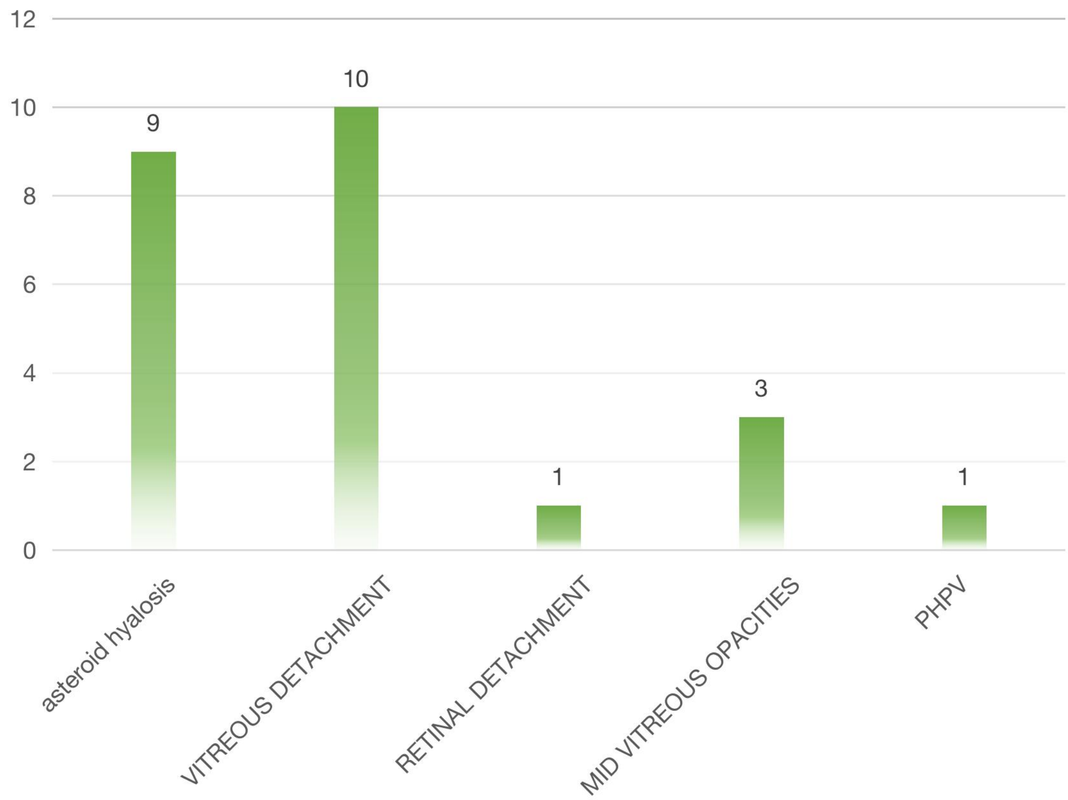


Table 14 Distribution of study population according to postoperative visual acuity.

Visual acuity	Frequency	Percentage
>6/60	72	87.80%
6/60 to HM+	10	12.19%

Table 15 Distribution of study population with abnormal B-scan according to the post operative visual outcomes

Sr no	B scan	Post operative Visual acuity			Total number of patient
		6/6-6/12	6/12-6/36	6/60	
1	Asteroid hyalosis	6	1	2	9
2	Posterior Vitreous detachment	4	2	4	10
3	MVO	2	-	1	3
4	RD	-	-	1	1
5	PHPV	-	-	1	1

TABLE 16 Distribution of study population according to frequency of poor visual outcomes

Abnormal B scan finding	Patients having good post operative vision	Patients having poor post operative vision
Asteroid hyalosis	77.77%	22.22%
Posterior vitreous detachment	80%	20%
Mid vitreous Opacity	100%	-

PHPV	**-**	**100%**
Retianl detachment	**-**	**100%**

CASE 1

Media clarity grade: Grade 4

Grade of cataract: Hyper-mature cataract

Eye: Right eye

B-scan diagnosis: Mid vitreous opacities

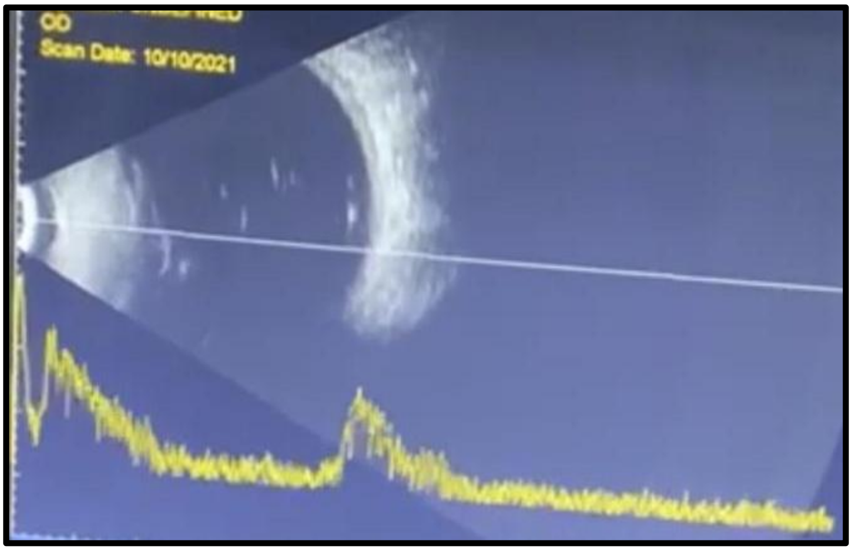


Figure 15: B-scan showing mid vitreous opacities in right eye of patient with hypermature cataract

CASE 2

Media clarity grade: Grade 4

Grade of cataract: Nuclear sclerosis 5

Eye: Right eye

B-scan diagnosis: Asteroid Hyalosis

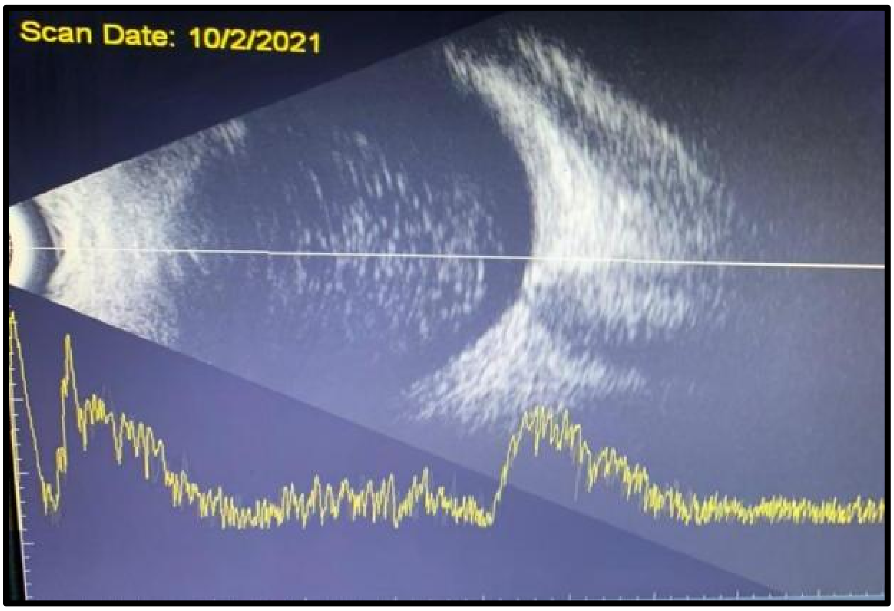


Figure 16: B scan showing asteroid hyalosis in right eye of patient with nuclear sclerosis 5

CASE 3

Media clarity grade: Grade 4

Grade of cataract: Hypermature cataract

Eye: Right eye

B-scan diagnosis: Posterior vitreous detachment

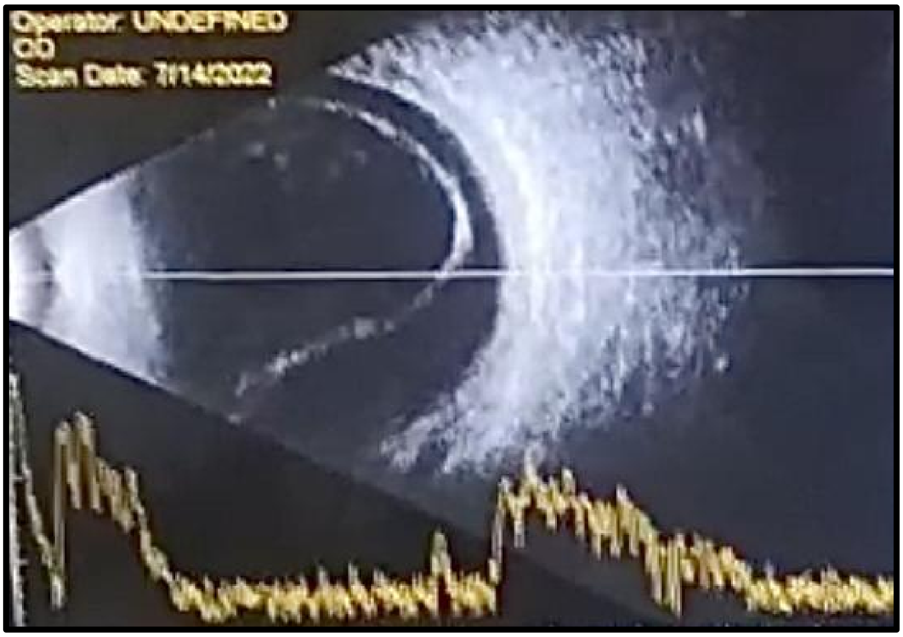


Figure 17: B scan showing posterior vitreous detachment in right eye of patient with hyper mature cataract

CASE 4

Media clarity grade: Grade 4

Grade of cataract: Mature cataract

Eye: Left eye

B-scan diagnosis: Retinal detachment

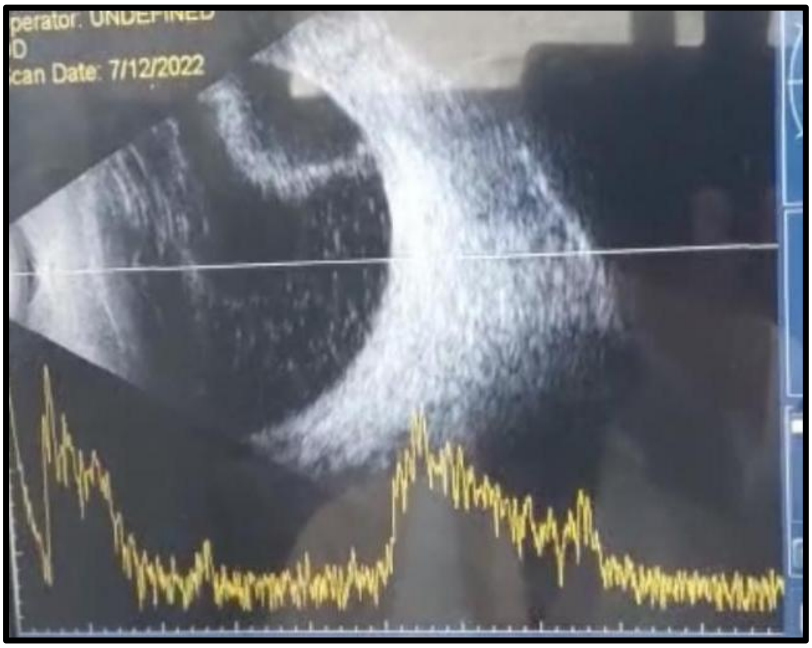


Figure 18: B scan showing retinal detachment in left eye of patient with mature cataract

CASE 5

Media clarity grade: Grade 4

Grade of cataract: Mature cataract

Eye: Left eye

B-scan diagnosis: Mid vitreous opacities

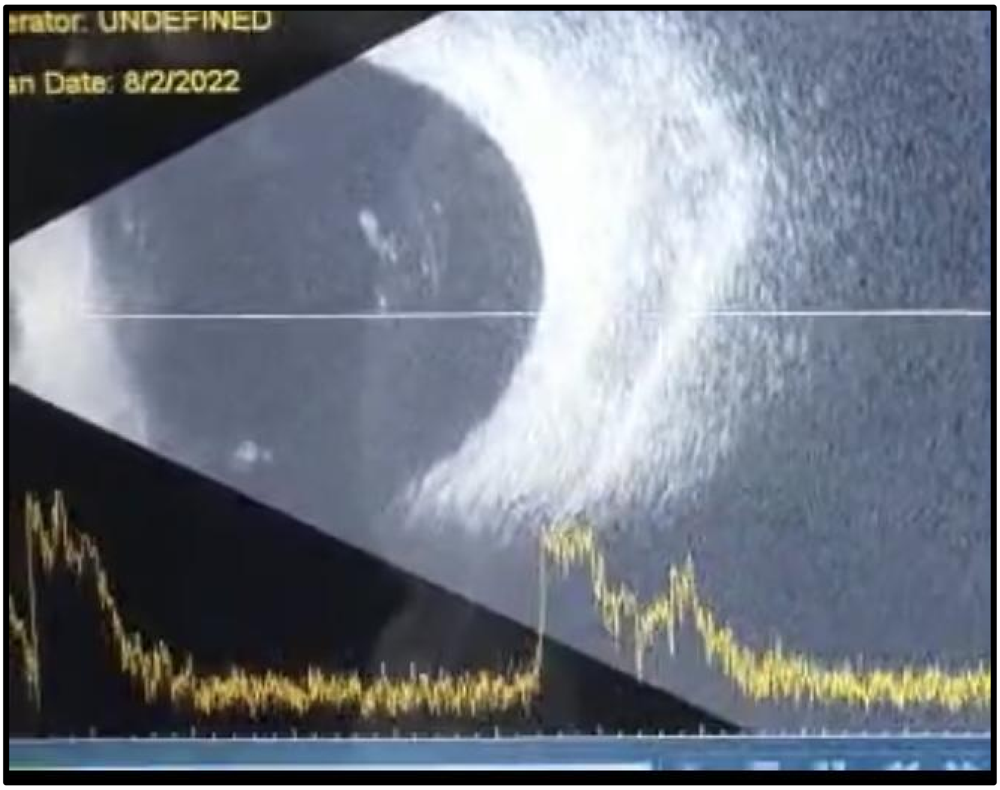


Figure 19: B scan showing mid vitreous opacities in left eye of patient with mature cataract

CASE 6

Media clarity grade: Grade 4

Grade of cataract: hyper Mature cataract

Eye: Right eye

B-scan diagnosis: Asteroid hyalosis

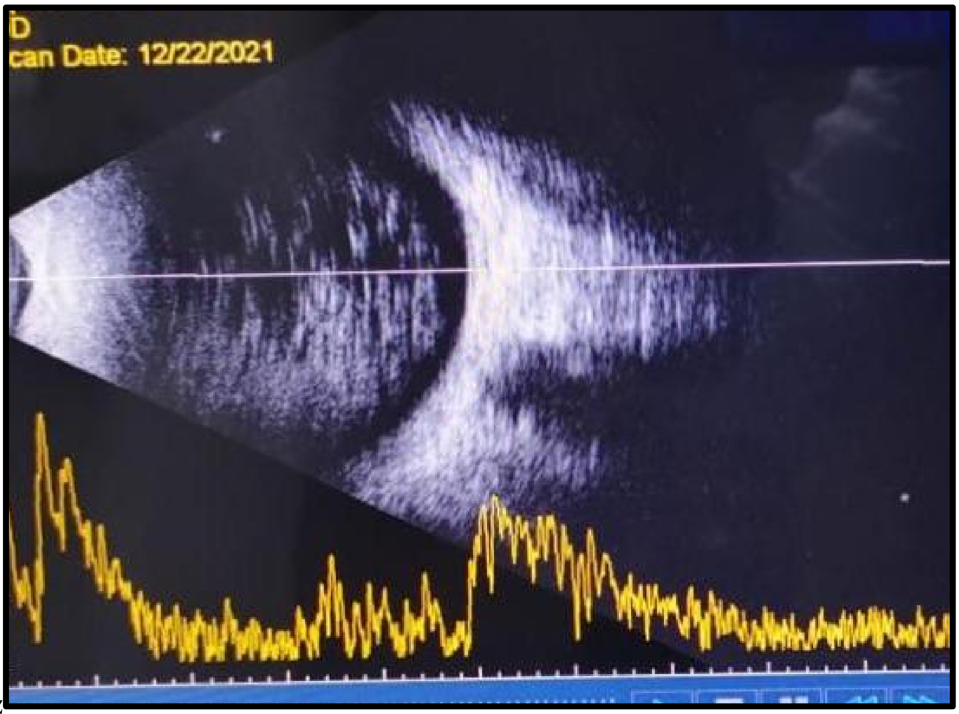


Figure 20: B scan showing asteroid hyalosis in right eye of patient with hypermature cataract

CASE 7

Media clarity grade: Grade 4

Grade of cataract: rmature cataract

Eye: Left eye

B-scan diagnosis: Posterior vitreous detachment

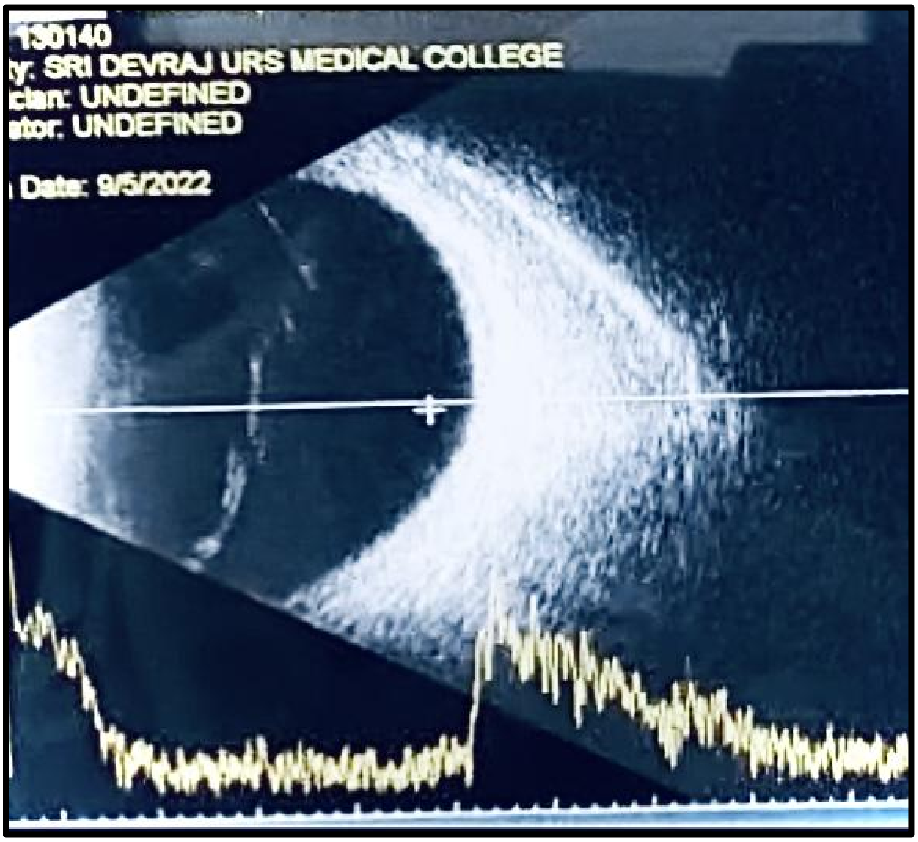


Figure 21: B scan showing posterior vitreous detachment in left eye of patient

DISCUSSION

Clinical examination of eye is not enough alone to diagnose and treat an ocular condition.Ultrasonography is an established and the most important diagnostic tools in the clinical practice . B-scan helps to diagnose and differentiate a variety of ocular pathologies.(32)

Ultrasound helps study the anatomical and pathological conditions of eye Within the last decade, B-scan screening of opaque ocular media, particularly in eyes with cataract and vitreous hemorrhage, has constituted one of the most common indications for ocular ultrasound examination.(52)

In this study, 89 cases were evaluated out of which 47 were males and 42 were females.A detailed history was taken and 5 patients had a history of trauma and 2 patient had corneal opacity which were excluded from the study

AGE AND SEX INCIDENCE:

Age distribution studied among study population is mentioned in table 6. Highest number of cases were seen among the age group of 61-70 years of age which constituted 43.90% of the study population and the least common age group was found to be <50 years (19.51%)

A study done by Praveen Vashist et al found that the prevalence of advanced cataract in people aged ≥60 was found to be 58% in north India (95% CI, 56–60) and in South India it was 53% (95% CI, 51–55). (P = 0.01).Among the study population, 42

(51.21%) were females and 40(48%) were males.[56]

Bangal et al conducted a study in 2016 where in among 100 cases, 54 were male patients and 46 were female patients.[35]

LATERALITY:

In this study, among 82 patients 43(52.43%) patients had dense cataract in right eye and 32 patient (39.02 had dense cataract in left eye. 7 patients (8.53%) had dense cataract in both eyes.

MEDIA OPACITY:

According to our study 48.8% patients had mature cataract in right eye and 31.7% patients had senile mature cataract in left eye

7.3% patients had hypermature cataract and 12.19% patients had hypermature cataract in right eye. 1.2% patients had nuclear sclerosis grade 4 in right eye and 4.87% patients had nuclear sclerosis in left eye . Although all cases had media clarity of grade 4.

Out of the study population, catract sugery and PCIOL implantation procedure was done for right eye in 45 patients while 37 patients were operated for left eye.

A total of 64 eyes with mature catract, 14 with hypermature cataract and 5 eyes nuclear sclerosis 4 were opearated.

PRE-OPERATIVE VISION:

21.95 % patients had vision more than 6/60 in right eye and 30.48% patients had vision more than 6/60 in left eye.

78.04% patients had poor vision <6/60 in right eye and 69.51% patients had poor vision, vision <6/60 in right eye.

DIAGNOSIS USING B-SCAN ULTRASONOGRAPHY:

Many studies were conducted about role of B-scan in detecting posterior segment and the commonest B-scan ultrasonography finding was a normal study.

In the present study also, the most common B- scan finding was normal in 70.73%.

Most common Asteroid hyalosis was seen in 10.97% patients.

A sum total of 82 cases who were suspected for posterior segment findings were studied. The distribution pattern of patients according to the B-scan finding are described in **Table No.13**

A study was done by Adebayo et al. with total number of 29 patients .

B-scan was done on of eyes. A total of 20 male and 9 female were included in the study.Patients from 5 days till 70 years were studied (mean 31 years). On examamination, vitreous hemorrhage was noted in in 7,, neoplasm in 4, foreign body in 2, and other indications in 3. RD was the commonest ultrasound finding. RD was found in 15 eyes, it was bilateral in two patients. Among the five cases of neoplasm 2 patients had retinoblastoma, 1 patient had subluxation of lens. The study concluded that Ultrasound B-scan of the eye and orbit is confirmatory, diagnostic and aids in management decisions of ocular and orbital lesions.(24)

RETINAL DETACHMENT

In our study, one patient with LE Hyper mature cataract showed RD on B scan. The pre operative vision was PL+ and PR accurate. The patient was taken for LE SICS with posterior chamber IOL implantation and the surgery was uneventful. After surgery the post operative vision of the left eye was 2/60 which was suspected as patient had RD.

Uncomplicated retinal detachment is defined as RD detected on B scan and is not associated with vitreous, sub-retinal space, or choroidal pathology.

The simultaneous detection of lesions in one or more of these areas may be a source of diagnostic confusion. High resolution B-scan ultrasonography provides a method for detection and diagnosis of retinal detachment, associated ocular pathology, and simulating conditions.(55)

Ninety-three diabetics (168 eyes) with opaque ocular media and low visual acuity (range amaurosis to 0.1) were examined by ultrasonography (B-scan) . Dense vitreous membranes were found in 112 (67%) eyes, 100 (60%) of which showed posterior membranes. Preretinal or prepapillary proliferation (extra retinal stalks) were demonstrated in 71 (42%) eyes. Fifty-four (32%) eyes had retinal detachments (40 localized, 14 total). These were present in 10 (50%) of the 20 amaurotic eyes. The ultrasonic accuracy was checked in 49 eyes at vitrectomy. It was 78% for retinal detachments and 67% for prepapillary and preretinal proliferation. The stalks circumscribed within 2 mm or less were the hardest to detect. Ultrasonography thus aids to predict the prognosis after vitrectomy.[57]

POSTERIOR VITREOUS DETACHMENT:

In our study 10 patients had vitreous detachment including 6 male and 4 female. Out of this 5 patients had mature cataract, 4 had hypermature cataract and one presented with nuclear sclerosis grade 4. All patients underwent SICS+PCIOL implantation procedure. The post op vision of 6 patients was >6/36 that is good vision, while 4 patients had vision less than 6/36.

The vision ranged from counting fingers close to 5/60.

Two hundred thirty-nine patients with acute-onset age-related PVD were admitted in a non referral hospital. Objective was to evaluate the performance characteristics of B-scan ultrasonography as a diagnostic test for the detection of retinal tears in acute symptomatic age-related posterior vitreous detachment (PVD). Comprehensive eye examination including vitreous and retinal biomicroscopy was performed on an emergency basis followed by blind B-scan kinetic Ultrasonography. Both diagnostic methods performed comparably. Proper B-scan kinetic US is a non invasive and accurate diagnostic method for the detection of retinal tears that can be reliably used in no view or small pupil cases with symptomatic PVD.[46]

A prospective study done by Mirshahi et al, evaluated the vitreous status of eyes was evalutated by B-scan ultrasonography before cataract surgery. Patients with the posterior vitreous attached were included for follow-up and examined 1 week, 1 month, and 1 year after uneventful phacoemulsification with PC IOL implantation. The preoperative prevalence and postoperative incidence of PVD were determined by ultrasonography. The study included 188 eyes of 188 patients (131 women, 57 men) with a mean age of 77.2 years. Preoperatively, 130 eyes (69.1%) had PVD and 58 eyes (30.9%) had no PVD. Postoperatively, 12 eyes (20.7%) developed PVD at 1 week, 18 eyes (31%) at 1 month, and 4 eyes (6.9%) at 1 year. The vitreous body remained attached to the retinain 24 eyes (41.4%) 1 year after surgery. No preoperatively measured parameter (eg. age, refraction, AL, effective phacoemulsification time) was predictive of the occurrence of PVD after cataract surgery. So here B-mode ultrasonography was very accurate in detecting PVD before and after cataract surgery.[56]

400 consecutive eyes were examined using biomicroscopy and B-mode ultrasonography and classified the PVD variations complete PVD with collapse, complete PVD without collapse, partial PVD with thickened posterior vitreous cortex 107(TPVC), or partial PVD without TPVC. In each PVD type, the most frequently seen ocular pathologies were as follows: in complete PVD with collapse (186 eyes),

age related changes without vitreoretinal diseases (77 eyes, 41.4%) and high myopia (55 eyes, 29.6%); incomplete PVD without collapse (39 eyes), uveitis (23 eyes, 59.0%) and central retinal vein occlusion (8 eyes, 20.5%); in partial PVD with TPVC (64 eyes), proliferative diabetic retinopathy (30 eyes, 46.9%); and in partial PVD without TPVC (111 eyes), age related changes without vitreoretinal diseases (62 eyes, 55.9%). This PVD categorisation was significantly associated with the prevalence of each vitreoretinal disease [57]

In our study, 1 (1.21%) patient presented with PHPV . The cataract grading was mature cataract and pre operative vision of the patient was PL+. The patient underwent SIMC+ PCIOL implantation.The patient's post operative vision was counting fingers 5 metres

POST OPERATIVE VISION:

In our study, 18 patient out of 82 patients had abnormal fundus study.

Out of 10 patients of vitreous detachment, 4 (20%) patients had poor vision.

Out of 9 patients of asteroid hyalosis, 2 patients (22.22%) had poor vision.

While in cases of retinal detachment and PHPV both patients (100%) had poor post operative vision that is less than6/36.

On the other hand out of 3 patients with mid vitreous opacity, all 3 patients (100%) had good vision.

Conclusion

B Scan is an non invasive diagnostic procedure which determines the extent and location of anatomical/ structural pathology to the posterior segment could be assessed in eyes with opaque media.

Surgeons can modify their plan of surgery and can also take measures to combat various predictable complications. In assessing visual prognosis, pre-operatively, B scan has proved to be useful as a simple tool.

B- scan ultrasonography is used in assessing the topography of mass lesions and assessing posterior segment abnormalities especially when retinal detachment or PHPV were suspected. The importance and necessity of ultrasonographic scanning when direct visualisation of the posterior segment by normal optical means is not possible due to opaque ocular media are stressed

Summary

B scan Ultrasonography has helped us immensely in diagnosis and proper evaluation of patients and in planning our surgery in cases that were operated.

- In our study 89 cases were evaluated out of which 47 were males and 42 were females.
- Detailed history was taken and 5 patients had a history of trauma and 2 patient had corneal opacity.
- These patients were excluded from the study
- The other 82 cases 42 female and 40 males were included from the study
- The pre operative vision was recorded and b-scan was done 69% of the subjects had normal B-scan in the operating eye
- Among the patients with abnormal findings on B-scan, the most common findings were vitreous detachment (12.19%), followed by asteroid hyalosis (10.97%)
- Post operative vision was recorded and 10 patients were recorded to have less than 6/60 vision that is low vision

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ANNEXURE

ANNEXURE- I

STUDY PROFORMA

NAME	CASE NO
AGE	DATE
SEX	DOA
	DOS

CHIEF COMPLAINT:

HISTORY OF PRESENTING ILLNESS

PAST HISTORY:

DM/ HTM/ BA/ EPILEPSY/ OCULARTRUMA/ OCULAR SURGERY

FAMILY HISTORY

PRESONAL HISTORY:

Appetite: Habbits

Sleep: Bowel/bladder

GENERAL PHYSICAL EXAMINATION

Pallor/icterus/lymphadenopathy/clubbing/cyanosis

VITAL SIGNS:

Bp pulse

Temperature respiratory rate

OCULAR EXAMINATION		
	RE	LE
HEAD POSTURE OCULAR POSTURE FACIAL SYMMETERY		
OCULAR MOVEMENTS		
VISUAL ACUITY (PRE-OPERATIVE) DISTANT PIN HOLE NEAR		
ANTERIOR SEGMENT LENS GRADING		
FUNDUS EXAMINATION		
B-SCAN		
MEDIA CLARITY		

EYE OPERATED:	POST OPERATIVE VISUAL ACUITY	POST OPERATIVE FUNDUS

ANNEXURE- II

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR - 563101

INFORMED CONSENT FORM

Group:

Case no:

IP no:

A QUALITATIVE ASSESSMENT OF B-SCAN FINDINGS IN PATIENTS WITH CATARACT OF MEDIA CLARITY OF GRADE 4

I, the undersigned, agree to participate in this study and authorize the collection and disclosure of personal information as outlined in this consent form.

I understand the purpose of this study, the risks and benefits of the technique and the confidential nature of the information that will be collected and disclosed during the study. The information collected will be used only for research.

I have had the opportunity to ask questions regarding the various aspects of this study and my questions have been answered to my satisfaction.

I understand that I remain free to withdraw the participation from this study at any time and this will not change the future care.

Participation in this study does not involve any extra cost to me.

Name	Signature	Date	Time
Patient			
Witness:			
Primary Investigator/ Doctor:			

ತಿಳಿವಳಿಕೆ ಸಮ್ಮತಿ ನಮೂನೆ

ಈ ಸಂಶೋಧನೆಗೆ ರೋಗಿಯ ಗುರುತಿನ ಸಂಖ್ಯೆ:

ಐಪಿ ಸಂಖ್ಯೆ:

ಕಾರ್ಟ್ರಾಕ್ ಕಣ್ಣಿನ ಪೊರೆ ಸಂಬಂಧಿತ ನಾಲ್ಕನೆಯ ಅಪ್ ಪಾರದರ್ಶಕತೆಯಿಂದ ವಧಿಸಲ್ಪಟ್ಟ ರೋಗಿಗಳಲ್ಲಿ ಸ್ಕ್ಯಾನ್ ಪರೀಕ್ಷೆಯಿಂದ ಕಂಡುಬರುವ ಗುಣಲಕ್ಷಣಗಳ ಸಂಕ್ಷೇಪ ಅಧ್ಯಯನ

ನಾನು, ಅಂಗೀಕರಿಸಿದ, ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳಲು ಮತ್ತು ಈ ಸಮ್ಮತಿಯ ರೂಪದಲ್ಲಿ ವಿವರಿಸಿರುವಂತೆ ವೈಯಕ್ತಿಕ ಮಾಹಿತಿಯ ಸಂಗ್ರಹ ಮತ್ತು ಬಹಿರಂಗಪಡಿಸುವಿಕೆಯನ್ನು ಅನುಮೋದಿಸಲು ಒಪ್ಪುತ್ತೇನೆ.

ಈ ಅಧ್ಯಯನದ ಉದ್ದೇಶ, ತಂತ್ರದ ಅಪಾಯಗಳು ಮತ್ತು ಪ್ರಯೋಜನಗಳನ್ನು ಮತ್ತು ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ಸಂಗ್ರಹಿಸಲ್ಪಟ್ಟಿರುವ ಮತ್ತು ಬಹಿರಂಗಪಡಿಸುವ ಮಾಹಿತಿಯ ಗೌಪ್ಯತೆಗೆ ನಾನು ಅರ್ಥಮಾಡಿಕೊಂಡಿದ್ದೇನೆ. ಸಂಗ್ರಹಿಸಿದ ಮಾಹಿತಿಯನ್ನು ಸಂಶೋಧನೆಗೆ ಮಾತ್ರ ಬಳಸಲಾಗುತ್ತದೆ.ಈ ಅಧ್ಯಯನದ ವಿವಿಧ ಅಂಶಗಳನ್ನು ಕುರಿತು ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲು ನನಗೆ ಅವಕಾಶವಿದೆ ಮತ್ತು ನನ್ನ ತೃಪ್ತಿಗೆ ನನ್ನ ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರ ನೀಡಲಾಗಿದೆ. ಈ ಅಧ್ಯಯನದಿಂದ ಭಾಗವಹಿಸುವಿಕೆಯನ್ನು ಯಾವುದೇ ಸಮಯದಲ್ಲಿ ನಾನು ಹಿಂಪಡೆಯಲು ಮುಕ್ತವಾಗಿರುತ್ತೇನೆ ಮತ್ತು ಇದು ಭವಿಷ್ಯದ ಕಾಳಜಿಯನ್ನು ಬದಲಿಸುವುದಿಲ್ಲ

ಎಂದು ನಾನು ಅರ್ಥಮಾಡಿಕೊಂಡಿದ್ದೇನೆ.

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವಿಕೆ ನನಗೆ ಯಾವುದೇ ಹೆಚ್ಚುವರಿ ವೆಚ್ಚ ಒಳಗೊಳ್ಳುವುದಿಲ್ಲ.

ಹೆಸರು	ಸಹಿ/ಹೆಬ್ಬೆಟ್ಟಿನ ಗುರುತು	ದಿನಾಂಕ	ಸಮಯ
ರೋಗಿಯ ಹೆಸರು			
ಸಾಕ್ಷಿಗಳ ಹೆಸರು			
ಪ್ರಾಥಮಿಕ ಸಂಶೋಧಕರು/ ವೈದ್ಯರು			

ANNEXURE-III

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR - 563101.

PATIENT INFORMATION SHEET

This information is to help you understand the purpose of the study "**A Cross Sectional Of B-Scan in Patient with Mature and Hyper mature Cataract Media Clarity of Grade 4".** You are invited to take part voluntarily in this research study, it is important that you read and understand the purpose, procedure, benefits and discomforts of the study.

1. What is the purpose of this study?
   - The purpose of this study is to evaluate the posterior segment anomalies using b-scan in patients with mature and hyper mature cataract with grade 4 media clarity.
2. What are the various investigations being used? Are there any associated risks?
   - There are absolutely no risks involved in the study.
   - The investigations used are
     a) B-scan

3. . What is the benefit for me as a participant?

Participation in this research study may not change the final outcome of your eye condition. However, patients in the future may benefit as a result of knowledge gained from this study. You will not be charged extra for any of the procedures performed during the research study. Your taking part in this study is entirely voluntary. You may refuse to take part in the study or you may stop your participation in the study at any time, without a penalty or loss of any benefits to which you were otherwise entitled before taking part in this study.

CONFIDENTIALITY

Your medical information will be kept confidential by the study doctor and staff and will not be made publicly available. Your original records may be reviewed by your doctor or ethics review board.

For further information/ clarification please contact

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ಶ್ರೀ ದೇವರಾಜ್ ಅರಸ್ ಉನ್ನತ ಶಿಕ್ಷಣ ಮತ್ತು ಸಂಶೋಧನಾ ಸಂಸ್ಥೆ, ಟಮಕ, ಕೋಲಾರ - 563101.

ರೋಗಿಯ ಮಾಹಿತಿ ಪತ್ರ

ಈ ಮಾಹಿತಿಯು ಕಾರ್ಟ್ರಾಕ್ ಕಣ್ಣಿನ ಪೊರೆ ಸಂಬಂಧಿತ ನಾಲ್ಕನೆಯ ಅಪ್ ಪಾರದರ್ಶಕತೆಯಿಂದ ವಧಿಸಲ್ಪಟ್ಟ ರೋಗಿಗಳಲ್ಲಿ ಸ್ಕ್ಯಾನ್ ಪರೀಕ್ಷೆಯಿಂದ ಕಂಡುಬರುವ ಗುಣಲಕ್ಷಣಗಳ ಸಂಕ್ಷೇಪ ಅಧ್ಯಯನ

1. ಈ ಅಧ್ಯಯನದ ಉದ್ದೇಶವೇನು?

ಈ ಅಧ್ಯಯನದ ಉದ್ದೇಶವು ಪ್ರಬುದ್ಧ ಮತ್ತು ಹೈಪರ್ಮೆಚರ್ ಕಣ್ಣಿನ ಪೊರೆಯ ರೋಗಿಗಳಲ್ಲಿ ಬಿ ಸ್ಕ್ಯಾನ್ ಬಳಸಿ ಹಿಂಭಾಗದ ವಿಭಾಗದ ವೈಪರೀತ್ಯಗಳನ್ನು ಮೌಲ್ಯಮಾಪನ ಮಾಡುವುದು.ಗ್ರೇಡ್ 4 ಮಾಧ್ಯಮ ಸ್ಪಷ್ಟತೆ

2. ಯಾವ ತನಿಖೆಗಳನ್ನು ಬಳಸಲಾಗುತ್ತದೆ?

ಈ ಅಧ್ಯಯನ ದಲ್ಲಿ ರೋಗಿಗಳಿಗೆ ಯಾವುದೇ ಅಪಾಯವಿಲ್ಲ

ಈ ಅಧ್ಯಯನ ದಲ್ಲಿ ಬಿ ಸ್ಕ್ಯಾನ್ ಬಳಸಲಾಗುತ್ತಿದೆ

3. ಭಾಗವಹಿಸುವವನಾಗಿ ನನಗೆ ಏನು ಪ್ರಯೋಜನ?

ಈ ಸಂಶೋಧನಾ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವಿಕೆಯು ನಿಮ್ಮ ಕಣ್ಣಿನ ಸ್ಥಿತಿಯ ಅಂತಿಮ ಫಲಿತಾಂಶವನ್ನು ಬದಲಿಸಬಾರದು. ಆದಾಗ್ಯೂ, ಭವಿಷ್ಯದಲ್ಲಿ ರೋಗಿಗಳು ಈ ಅಧ್ಯಯನದಿಂದ ಪಡೆದ ಜ್ಞಾನದ ಫಲಿತಾಂಶವಾಗಿ ಪ್ರಯೋಜನ ಪಡೆಯಬಹುದು. ಸಂಶೋಧನಾ ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ನಡೆಸಿದ ಯಾವುದೇ ಪ್ರಕ್ರಿಯೆಗಳಿಗೆ ನಿಮಗೆ ಹೆಚ್ಚುವರಿ ಶುಲ್ಕ ವಿಧಿಸಲಾಗುವುದಿಲ್ಲ. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ನಿಮ್ಮ ಪಾಲ್ಗೊಳ್ಳುವಿಕೆಯು ಸಂಪೂರ್ಣವಾಗಿ

ಸ್ವಯಂಪ್ರೇರಿತವಾಗಿದೆ. ಅಧ್ಯಯನದಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳಲು ನೀವು ನಿರಾಕರಿಸಬಹುದು ಅಥವಾ ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳುವುದಕ್ಕೆ ಮುಂಚಿತವಾಗಿ ನೀವು ಯಾವುದೇ ಅರ್ಹತೆಯಿಂದ ಯಾವುದೇ ದಂಡ ಅಥವಾ ನಷ್ಟವಿಲ್ಲದೆಯೇ ಯಾವುದೇ ಸಮಯದಲ್ಲಿ ನೀವು ಭಾಗವಹಿಸುವಿಕೆಯನ್ನು ನಿಲ್ಲಿಸಬಹುದು.

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ಗೌಪ್ಯತೆ

ನಿಮ್ಮ ವೈದ್ಯಕೀಯ ಮಾಹಿತಿಯನ್ನು ಅಧ್ಯಯನದ ವೈದ್ಯರು ಮತ್ತು ಸಿಬ್ಬಂದಿ ಗೌಪ್ಯವಾಗಿಡಲಾಗುವುದು ಮತ್ತು ಸಾರ್ವಜನಿಕವಾಗಿ ಲಭ್ಯವಿರುವುದಿಲ್ಲ. ನಿಮ್ಮ ಮೂಲ ದಾಖಲೆಗಳನ್ನು ನಿಮ್ಮ ವೈದ್ಯರು ಅಥವಾ ನೈತಿಕ ವಿಮರ್ಶೆ ಮಂಡಳಿ ಪರಿಶೀಲಿಸಬಹುದು. ಹೆಚ್ಚಿನ ಮಾಹಿತಿಗಾಗಿ ಸಂಪರ್ಕಿಸಿ

ಡಾ ಪಟೇಲ್ ಅಪರ್ಣಾ

ಪ್ರೊಫೆಸರ್

ಡಿಪಾರ್ಟ್ಮೆಂಟ್ ಆಫ್ ಒಫ್ಥಲ್ಮೊಲೊಜಿ

ಎಸ್ ಡಿ ಯು ಎಂ ಸಿ

ಟಮಕ, ಕೋಲಾರ

ಷಂ!ಕಥ ಷಂಖ್ಯೆ: 7741807756

Key to master chart

PSC: Posterior subcapsular cataract

NS: Nuclear cataract

HM: Hand movements

PL: Perception of light

PR: Projection of rays

MVO: Mid vitreous opacity

PVD: Posterior vitreous detachment

RD: Retinal detachment

PHPV: Persistent Hyper-plastic Primary Vitreous