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ROLE OF ULTRASOUND IN EVALUATION OF OCULAR LESIONS.

Radiodiagnosis

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ABSTRACT

Over the last 30 years, ultrasound has greatly advanced, and now its most common use is in contact mode for evaluation of the posterior segment in eyes with media opacification. Diagnostic B-scan ultrasound can accurately define intraocular structures and give valuable information on the status of the lens, vitreous, retina, choroid, and sclera. Aim of the study is to highlight the importance of ultrasound in the assessment of ocular examination.

KEYWORDS

Ultrasound B scan, ocular lesions, B scan eye.

INTRODUCTION:

The eye is affected by a spectrum of pathological conditions occurring in all age groups from newborn to old age. Although clinical study and ophthalmoscopy are the basis of diagnosis in most patients with eye diseases, especially when the clinical examination of the fundus is difficult[1].

Ultrasound is a safe technique, cheaper and more affordable compared to other methods that would also provide useful data (such as OCT, CT, MRI). B scan (brightness) mode is useful for a better demonstration of the shape and topographic relationship of lesions in the posterior segment[2].

Situations that prevent normal examination of fundus include lid problems (e.g., severe edema, partial or total tarsorrhaphy), corneal opacities, hyphema, hypopyon, pupillary membranes, dense cataracts, or vitreous opacities like hemorrhage, inflammatory debris.

Ophthalmic ultrasonography has become the mainstay of imaging modality for direct evaluation of lesions of the posterior segment.

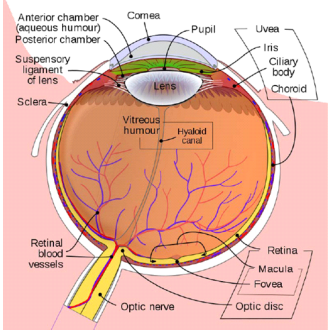


Figure showing graphical representation of different layers of the eye

MATERIALS AND METHODS:-

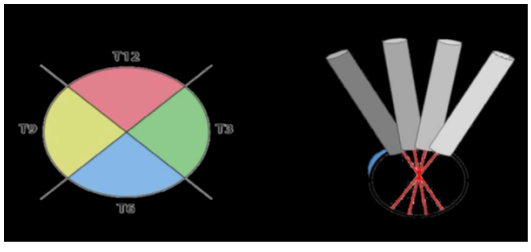
This prospective study was conducted in Dr. PINNAMANENI SIDDARTHA INSTITUTE OF MEDICAL SCIENCES AND RESEARCH FOUNDATION, CHINNAOUTPALLI. During the period of November 2016 to September 2018, 170 patients who fulfilled the inclusion criteria of all the patients who are not evaluated by ophthalmic fundus examination & to document and further assess posterior segment pathologies visualized by ophthalmoscopy.

Radiographic instrumentation:

Philips affinity 50G ultrasound machine with probe frequency of 5-12MHz in department of radio diagnosis.

Technique:

Examine the entire globe in five steps, i.e., four dynamic views of quadrant and also static slice through macula and optic disc, also known as longitudinal macula (LMAC). These views are designated T3, T6, T9, and T12. These quadrantsrefer to the clock face superimposed on an eye.



The technique we have employed in this study for examination is first to instruct the patient about the procedure and ask the patient to close his eyes.

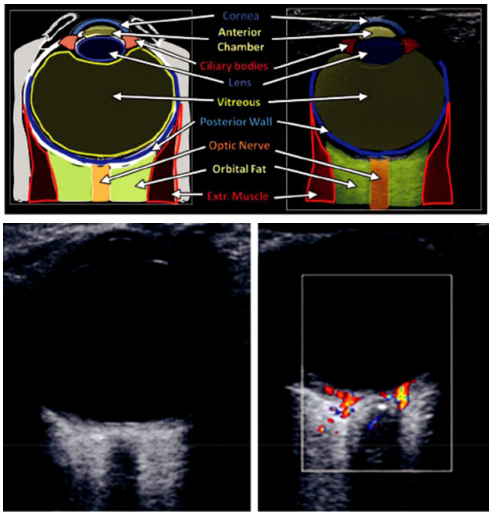
Then a gel pad that is sterile is placed over the eyelid of the patient and place the high-frequency linear transducer; we have used a linear transducer of frequency 5 – 12 Mhz.

Then the probe is placed gently on to the gel pad, and care is to be taken to place it gently over the eye of interest and first examine the axial length.

This is taken from the corneal surface to the attachment of the optic nerve to the globe.

The quadrants are centered to the screen by gently moving the probe footprint, towards the desired direction to attain a maximal quality of the image. The images are taken in both transverse and longitudinal positions. Then the optic nerve sheath is examined to the visualized extent. Then color doppler is employed, and the status of the vasculature of the globe is assessed.

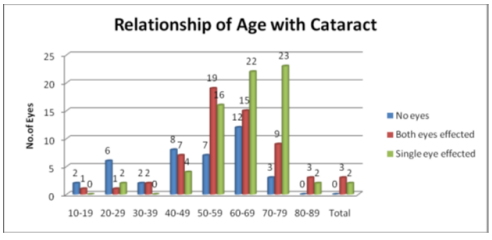
The patient is then instructed in their language to move the eye without opening the eyelids gently. This allows in the assessment of the dynamic motion of the eye, thus helps in better assessment of the different layers.

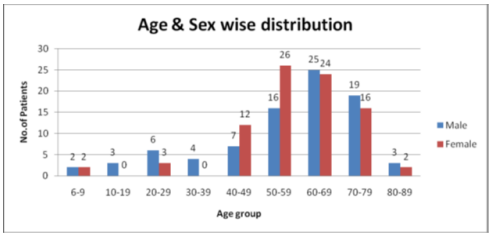


Grey scale & color doppler of B scan of eye

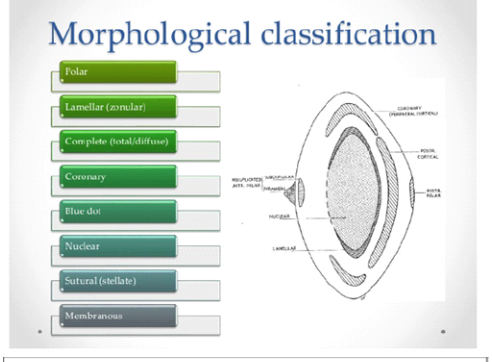
RESULTS:

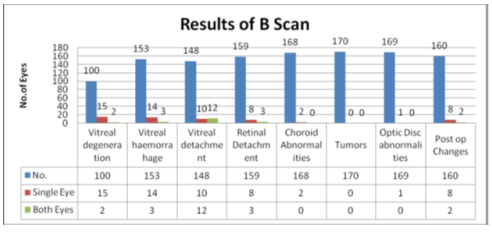
Out of 170 patients with cataractous changes in one and / or both the eyes are tabulated as:

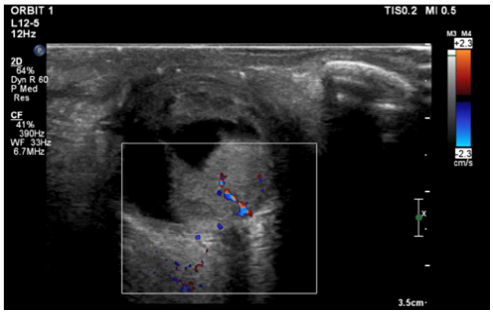




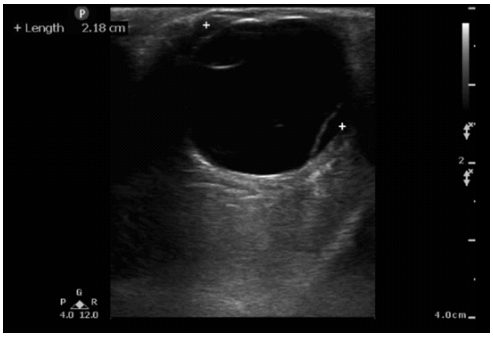
Here is the classification of morphological types of cataract.



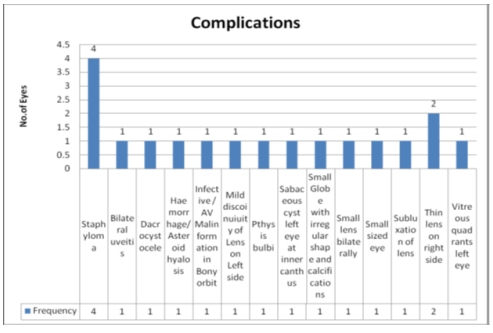




B scan showing Vitreal hemorrhage



B scan showing vitreal detachment



DISCUSSION:

With the advent of B mode, we can visualize the eye in its entirety and can even look beyond the eye to a little extent. Color Doppler helps in assessment of the lesions and brings a new dynamic to narrow down the extent of the lesion if any and brings a few differentials out and thus helps in better diagnosis.

AGE:

Of the total of 170 patients in this study, the patients were divided according to decades. The total number of patients in each decade is 4 in first decade, 3 in second decade, 9 in the third decade, 4 in the fourth decade, 19 in the fifth decade, 42 in the sixth decade, 49 in the seventh decade, 35 in the eighth decade and 5 in the ninth decade of life. The peak population in this study was from the seventh decade, followed closely by the sixth decade and eight decades. This result is in close agreement with the study done by Manzoor Qureshi[2] and with a study on American study population in 2000. The patients from the first two decades belong to either from a congenital developmental disorder/anomaly and other being traumatic.

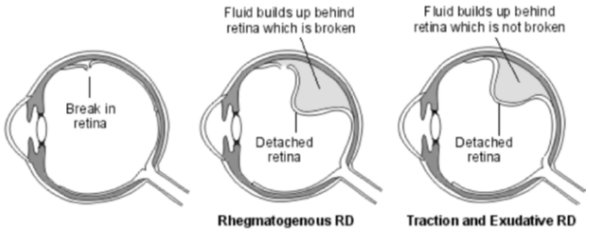
Gender:
This number in women population is significantly higher in our study when compared to literature. This holds good in several types of research done in both developing and developed countries. This is attributed to the factors like, the initiative of government under the national programme for control of blindness in India (NPCB), VISION 2020 which are centrally controlled bodies.

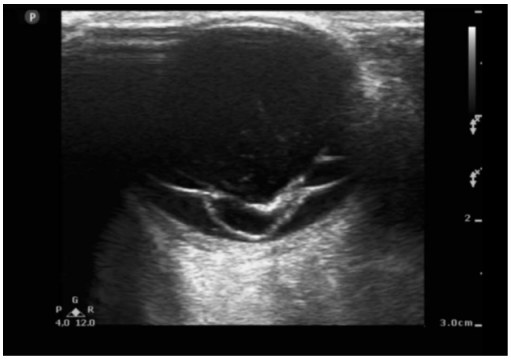
Cataract:
This is the most common cause of blindness in India and globally. This accounts for nearly 60% of blindness in the elderly population. The lens, in general, is a lucent structure, composed of the majority of water and protein interspersed specifically. As age progress, the changes in the lens are seen in the form of clumping of lens proteins and these results in the cloudy/frothy appearance of the lens. These are in accordance with the study done by Manzoor Qureshi.

Vitreous:
The major commonest forms of vitreal pathology we encountered in this study is vitreal detachment followed by vitreal hemorrhage.

Vitreal hemorrhage is seen in approximately 10% of patients, of which majority belong to the nontraumatic group. These are also commonly associated with cataractous changes, though it is not statistically significant to suggest any underlying patho physiological process. On dynamic / kinetic motion the marked elasticity of the detached vitreous with mirror image configuration, when the eye is turned in to and fro sideways motion. In this study vitreal detachment is seen in one eye in 10 (5.9%) patients and in both eyes in 12(7.1%) patients.

Retina:
The main differentiating feature between knowing the level of detachment, i.e., between vitreal and retinal layers is that retina is attached to ora serrata anteriorly and to optic nerve head posteriorly. This anatomical landmarks help in the delineation of the layers and aim in diagnosis. B mode USG helps in deciding the extent and type of surgical intervention needed. Assessment of sub retinal fluid collection is crucial in treatment procedure like vitrectomy.





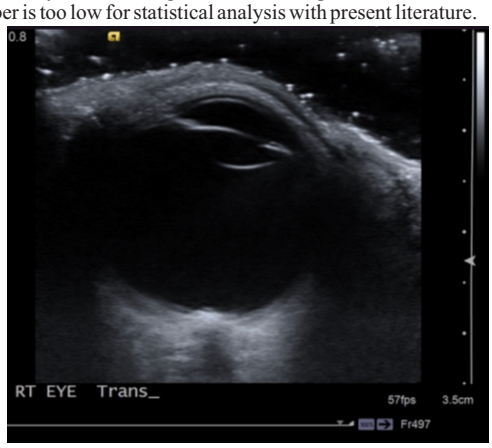
Grey scale B scan showing retinal detachment

Choroid & Ocular tumors:
The choroid is thicker than retina. Commonest pathology is a detachment of choroid.

This can occur either spontaneously or as a complication of the surgical procedure. It appears as a uniform, dome-shaped and thick membrane. When it is severe, it causes multiple domes shaped bullous detachments, which may meet in the vitreal cavity. In this study, there were no recorded cases of tumors.

Optic nerve abnormalities:
B scan USG drusen are seen as elevation at optic nerve with calcification. On B scan papilloedema, is also seen in a similar fashion with an elevation of optic nerve but whereas optic neuritis was presented as thickening of optic nerve with an added elevation of the optic disc.

In this study, we have diagnosed a case of optic nerve drusen since the number is too low for statistical analysis with present literature.



Grey scale image showing optic drusen

Limitations:
Study differs from study by Mansoor Qureshi[2] in that it is not divided into a traumatic and nontraumatic cataract. This is due to the factoring of any suspected orbital injury in association with ocular injury and any intracerebral injury as USG has a limited role. CT was used as the first choice of investigation when a head injury is suspected. In case of air pockets in the retro ocular and pre-septal fat can also hinder the study with USG.

In this study, there were no recorded cases of tumors. This is partly due to the limitation of assessment of mass lesions in its entirety like extension into the retro ocular space, post septal space, posterior extraconal space, intraconal space and intra cerebral part of the optic nerve. Furthermore, the extension into adjacent extraocular muscles cannot be diagnosed in early stages. This holds good for the involvement of the optic nerve sheath in earlier stages too. Any bony involvement no matter how large cannot be diagnosed with USG alone. Due to these limitations, USG is not the preferred choice of diagnostic investigation.

In case of suspicion of a mass lesion, CT holds higher values of specificity and sensitivity than USG for its ability to delineate the bony osseous lesions. However, MRI remains gold standard in the evaluation of lesion as it provides unparalleled soft tissue contrast and contrast administration and dynamic contrast techniques can further help in the assessment of localization of even the smallest lesions.

CONCLUSION:
B mode ultrasound is a quintessential, fast, non – invasive and bio-safe method for examination of complex anatomical structure (Eye). Diagnostic accuracy was obtained using an all-purpose high-frequency transducer and still achieve satisfactory results, there it is readily accessible to the radiologist.

B mode is quintessential in diagnosing posterior chamber pathologies. A diagnostic difficulty arises in eyes with multiple pathologies, especially focal retinal detachment differentiation of it from dense echogenic pre-retinal vitreal cavity membranes.

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