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ROLE OF ULTRASOUND IN SHALAKYA PRACTICES (OPHTHALMOLOGY)

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ABSTRACT

Background:
Medical Ultrasonography is one of the advance diagnostic imaging tools using echoes of ultrasound pulses to delineate objects or areas of different density in the field of Shalakya practice especially ophthalmology. It is a simple, non-invasive and affordable tool for diagnosing pathology of the eyelid, cornea, anterior segment and posterior segment of the eyeball. Because the eye is a superficial fluid filled structure, ultrasound is an easy to use modality for visualization of ocular pathology and anatomy. The principles of ocular ultrasound are the same as other applications of this technology. Sound waves are generated at a frequency greater than 20,000 Hz and reflected back to the transducer by tissue in its path.1 Common clinical conditions such as cataract, vitreous degeneration, retinal detachment, ocular trauma and choroidal masses can be accurately evaluated with this modality. Three types of USG viz. A-scan, B-scan and C-scan are available among which B-scan is widely used in daily clinical practice.

Aims & Objectives:

- *Use of USG in diagnosis of ocular pathology*
- *To measure axial dimension*

Materials and Method:
Diagnostic Ultrasounds are selected according to as per need of study. High frequency probe is placed over the closed eyelid after application of coupling gel.

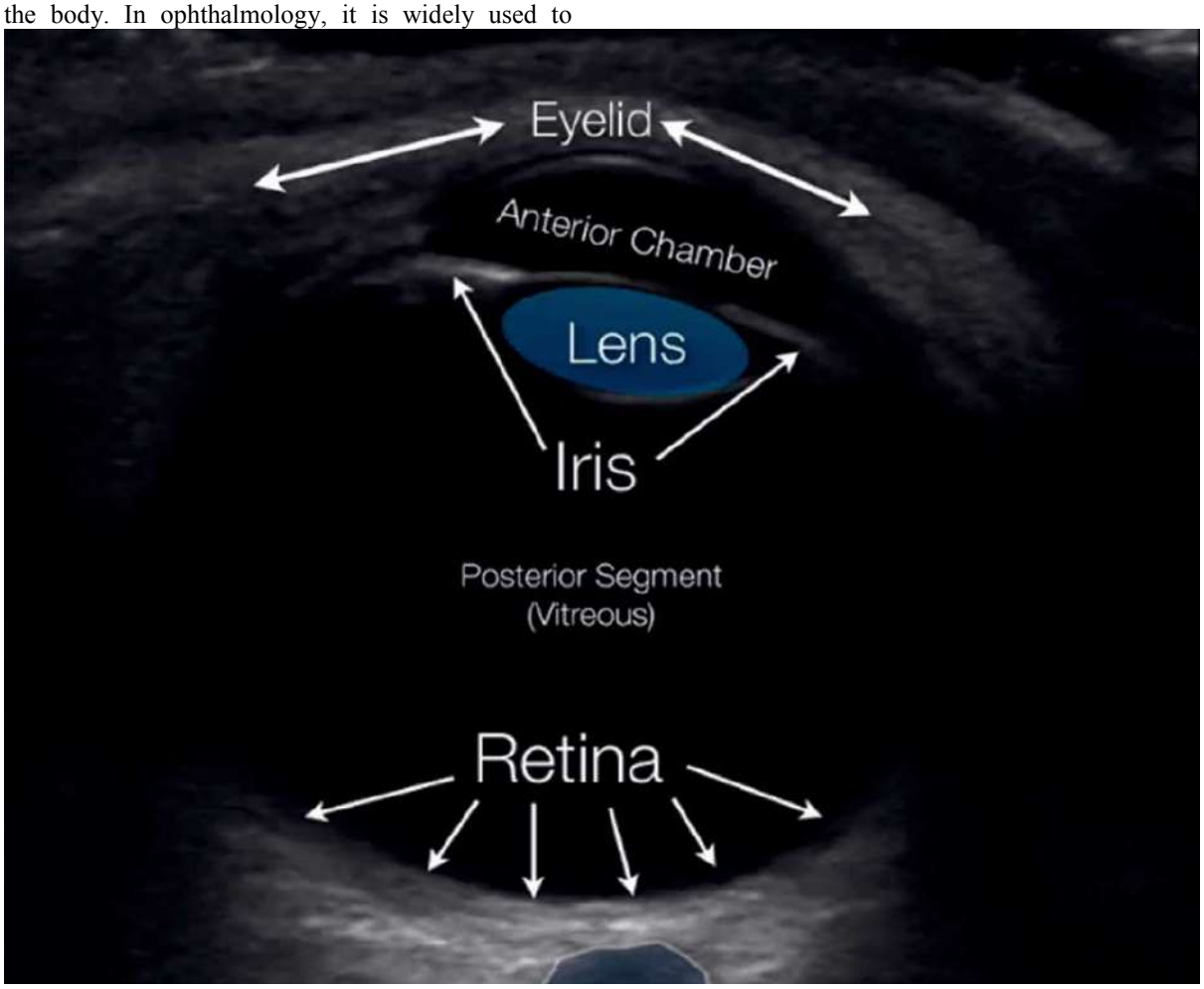
Results:
The diagnostic ultrasound provides accurate diagnosis of the ocular pathology.

Conclusion:
Ultrasound is an excellent, non-invasive, rapid diagnostic tool in assessing intraocular pathology. The images provide essential and detailed information about the pathology, helping in the decision regarding early diagnosis and treatment, before chronic changes have occurred.

KEY WORDS: *Ocular ultrasound; A-scan; B-scan; C-scan and Ocular pathology.*

INTRODUCTION

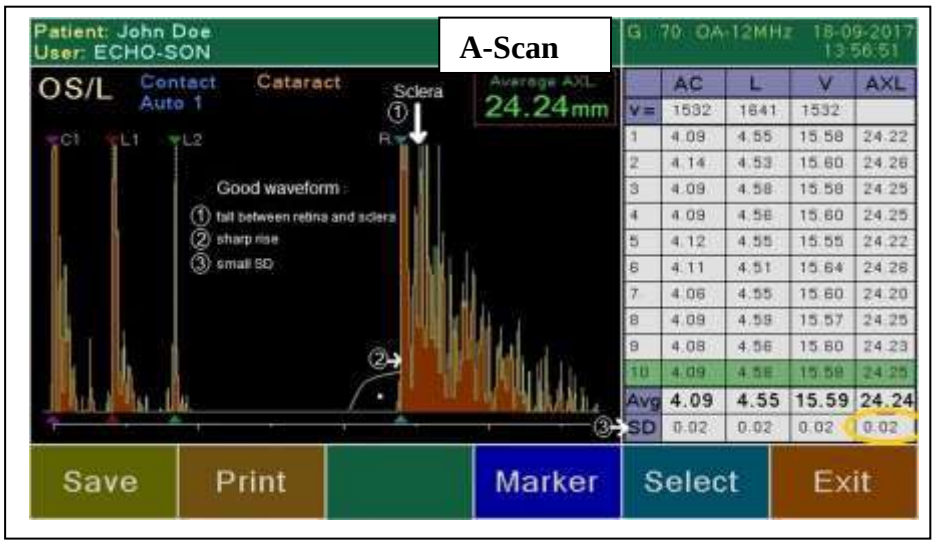
Medical Ultrasonography is a diagnostic imaging technique using echoes of ultrasound pulses to delineate objects or areas of different density in the body. In ophthalmology, it is widely used to diagnose the ocular pathology and also known as Ultrasound Biomicroscopy. Ultrasound Waves are acoustic waves that have frequencies greater than 20 KHz

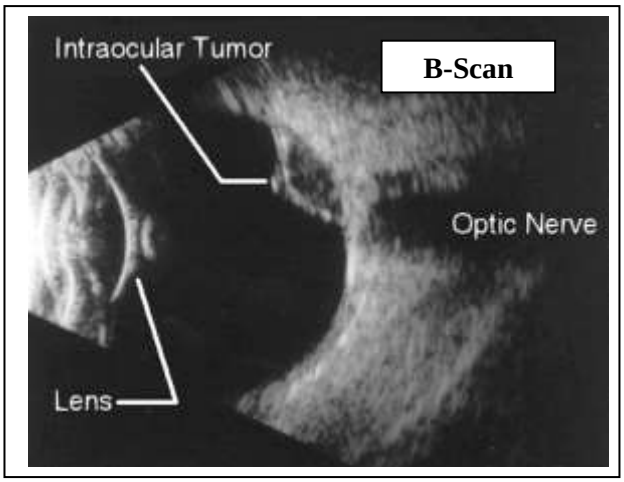


TYPES:

There are three types of medical diagnostic ultrasound used in ophthalmology.

- A-scan
- B-scan
- C-scan





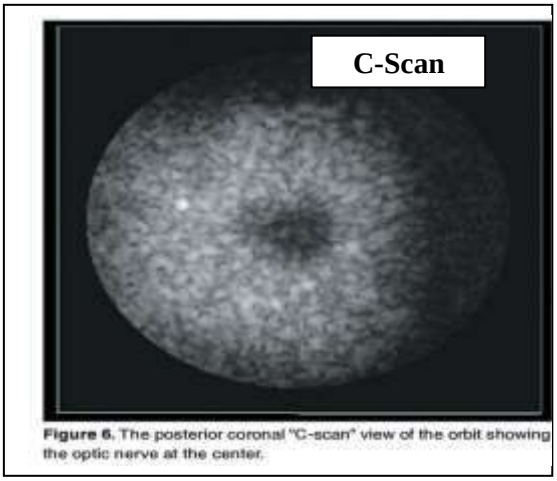
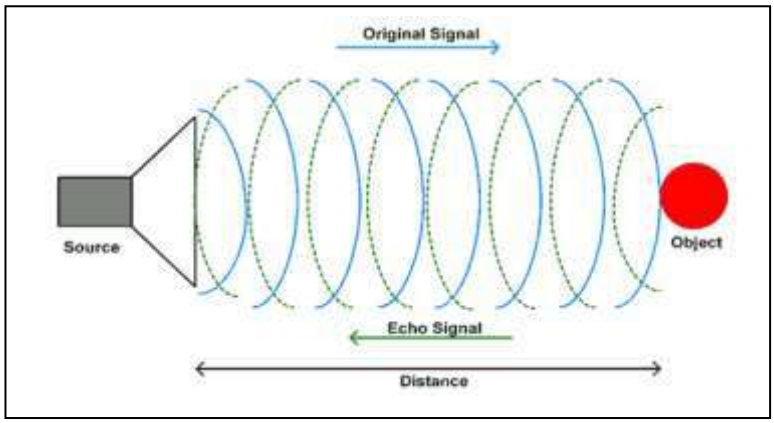


Figure 6. The posterior coronal "C-scan" view of the orbit showing the optic nerve at the center.

PRINCIPLE OF USG

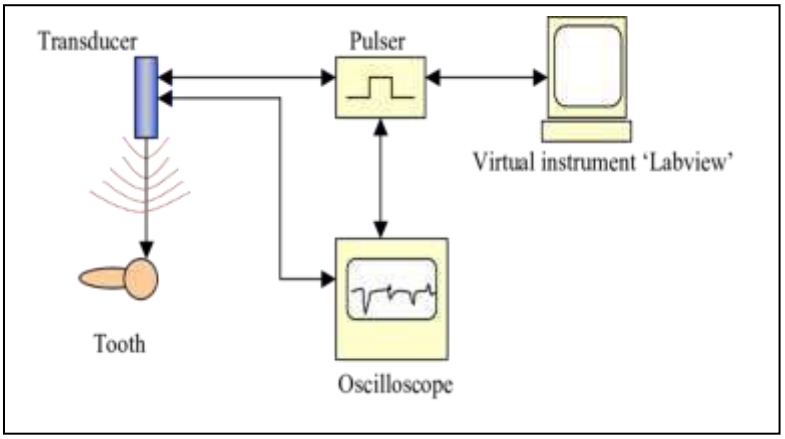
- It acts on the principle of sonar and radar.
- Ultrasound waves of high frequency are transmitted into the body through Transducer which after striking the target structures reflect & scatter back. Sound waves that return to the transducer are called echoes. When the sound wave returns, a piezo-electric crystal in the transducer vibrates, resulting in electrical impulses that are translated into an image or other data.[2]
- The image thus formed may be **Hyperechoic, Hypoechoic or anechoic.** [3]
- Hyperechoic mass suggests brighter mass in comparison to the surrounding tissues.
- Hypoechoic mass appears darker than the surrounding tissue.
- Anechoic mass appears black due to complete absence of echoes.
- Higher frequency waves penetrate lesser into tissue but have better resolution and vice-versa.
- Coupling gel is used to reduce ACOUSTIC IMPIDENCE between the Transducer & Skin



INSTRUMENTATION (A, B & C-SCAN)

The unit consists of 4 elements-

- Pulser
- Receiver
- Transducer
- Display unit



Pulser:

It is a component of an ultrasound instrument that provides signals for exciting the piezoelectric transducer in order to transmit an ultrasound beam.

Receiver:

It is a device that receives an ultrasound signal and decodes it for use as sound, navigational-position information, etc.

Transducer:

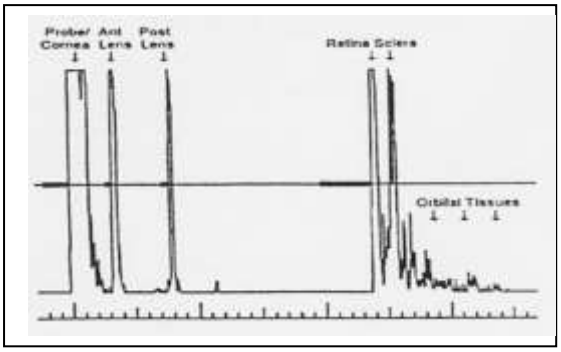
An ultrasound transducer also called probe converts electrical energy into mechanical (sound) energy and back again, based on the piezoelectric effect. It is the hand-held part of the ultrasound. It is a very important sensor which generates acoustic signals and also detects returned signals.

Display unit:

It is the monitor or screen where the processed information from the receiver is displayed.

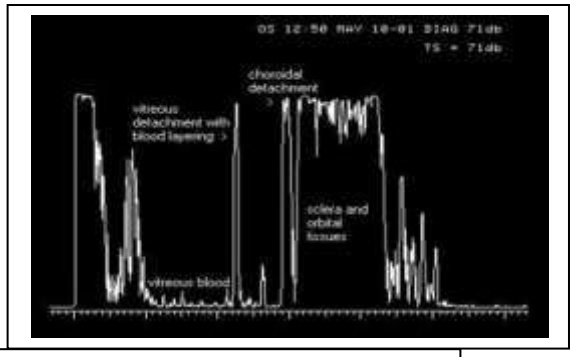
A-SCAN

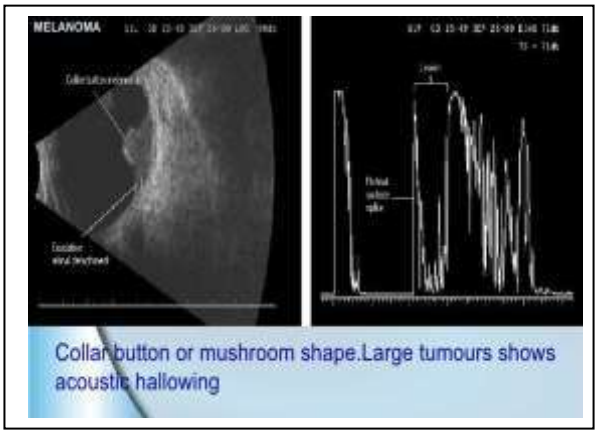
- A-scan or Time-amplitude scan is one dimension display and provides data on the length of the eye.
- Sound waves are generated by 8 MHz probe at a depth of 15-35mm and converted into spikes. that correspond with tissue interface zones.
- Echoes represented as vertical spikes (Time Amplitude).
- X axis shows time elapsed (function of tissue depth).
- Y axis-reflectivity in decibels.
- Provide quantitative information.

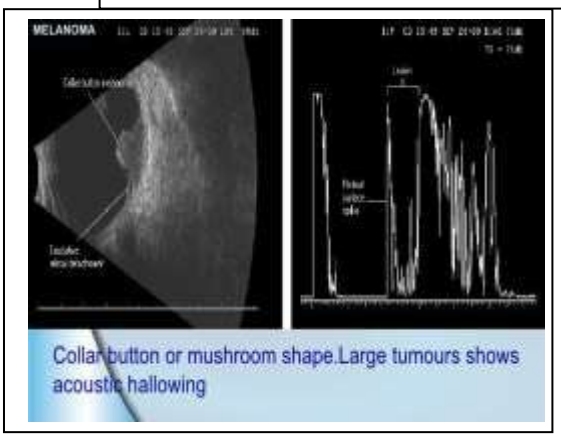


INDICATIONS OF A-SCAN

1. To determine eye length for calculation of IOL power.
2. To determine the size and USG characteristics of ocular masses.
3. To determine the size of axial length
4. Lens Dislocation
5. Vitreous Detachment
6. Retinal Detachment
7. Choroid Detachment







B-SCAN

- It is also called Brightness amplitude mode 2D Display.
- In this scan, sound waves are generated by 10 MHz frequency transducer.
- The data collected by the transducer
- produces a corresponding image.
- Used for the clinical assessment of real time various ocular and orbital pathology.
- Widely used in Ophthalmic practice
- Focussed beam is used
- Provides Topographic Information

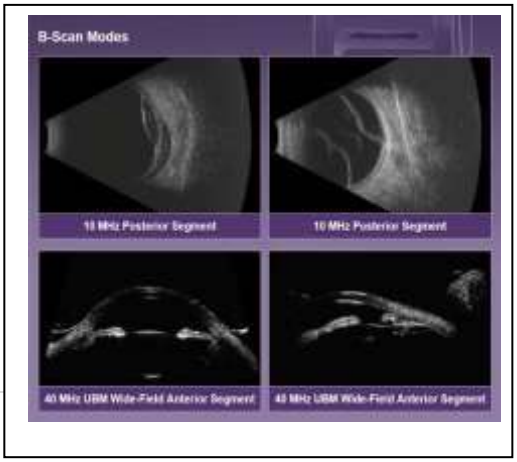
INDICATIONS OF B-SCAN

Anterior Segment:

- Lid Problems
- Corneal Opacity
- Hypopyon/ Hyphema
- Iris lesion
- Miosis, Pupillary membranes
- Ciliary Body lesion
- Cataract

Posterior Segment:

- Vitreous opacities (VH,Inflamatory debris).
- Retinal Pathology (RD, TRD, PVD, Tumors & masses, IOFB detection, OD abnormality).
- Choroid masses and haemorrhage.
- Trauma.



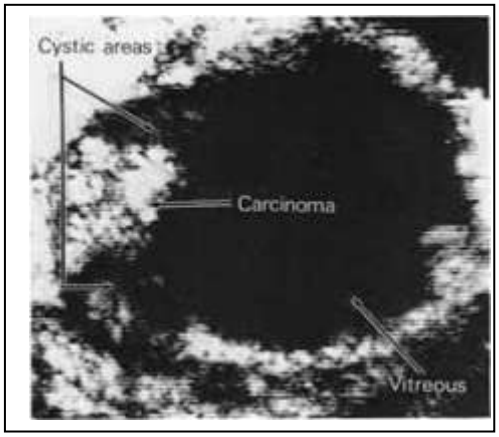
B-Scan Transducer

C-SCAN

- Recently highly developed ultrasonic system.
- CORONAL Plane 3D USG.[4]
- Principle similar to B-Scan.
- Transducer >10 MHz frequency.

INDICATIONS OF C-SCAN

- To demonstrate the normal orbital fat and optic nerve, together with selected pathological conditions in the orbit.
- Orbital lesions.
- Optic nerve lesion and diameters measurements.



CONCLUSION

Ultrasound is an excellent, non-invasive, rapid diagnostic tool in assessing intraocular pathology. The images provide essential and detailed information about the pathology, helping in the decision regarding early diagnosis and treatment, before chronic changes have occurred.

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