OPHTHALMIC ULTRASOUND
Indications, Examination And Interpretation

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Scope

- Introduction
- Indications
- Interpretation
- Examination
- Applications

Introduction

- Developed in the late 1950s and early 1960s
- An important test for clinical evaluation of opaque media globe and abnormal orbit.
- Useful for intraocular and orbital tumor identification in clear media
- Tomographic 3D ultrasonic imaging of the anterior and posterior segment now possible

Introduction

- Ultrasound is an acoustic wave with a frequency greater than 20 kHz.
- Frequencies used are:
  - 8 to 25 MHz for imaging the posterior segment of the eye and orbit
  - 50 MHz for imaging the anterior segment.
  - Physiological hearing up to 18MHz

Introduction

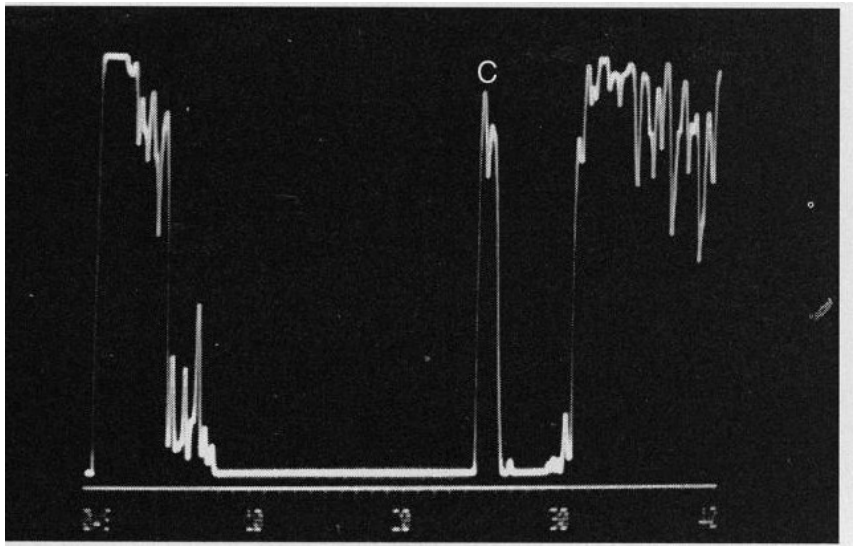
- Involves the generation of sound waves at frequencies greater than 20 KHz.
- Caused by the vibration of a thin crystal stimulated by pulses of electric current.
- The sound waves propagate through a medium and are reflected by tissue surfaces back to the resting crystal
- The crystal is made to vibrate, generating electrical impulses .
- The reflected echoes are received, amplified, and electronically processed .
- Displayed in A-scan or B-scan images.

Indications for ophthalmic ultrasonography

- For visualization of the posterior segment otherwise obscured by a dense cataract or cloudy cornea.
- For examination of the retrobulbar and orbital structures.
- For biometry

A-scan (A-mode or time-amplitude) ultrasonography

- A-scan is for tissue characterization and interpretation
- The horizontal axis represents time or distance, useful for linear measurements
- The vertical axis reveals echo amplitude; useful for characterizing tissues



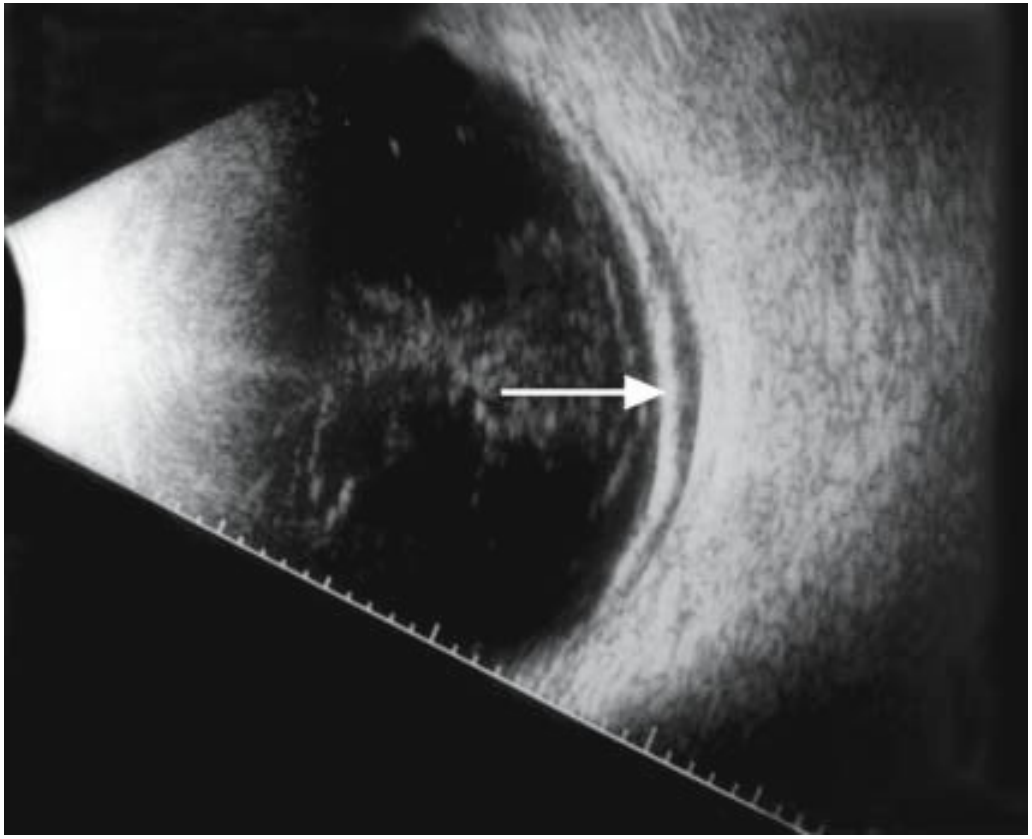
A scan

A- scan

- The first spike, always the tallest represents the interface between probe and cornea.
- Next, two spikes separated by a short distance; anterior and posterior lens.
- A flat line represents the vitreous.
- A series of spikes progressively reducing in amplitude then follow – the retina, sclera, orbital tissues etc.

. B-scan (B-mode or intensity-modulated)

- B-scan provides a cross-sectional image of the globe and orbit.
- Used predominantly for topographic information (anatomic location, shape, borders, size)

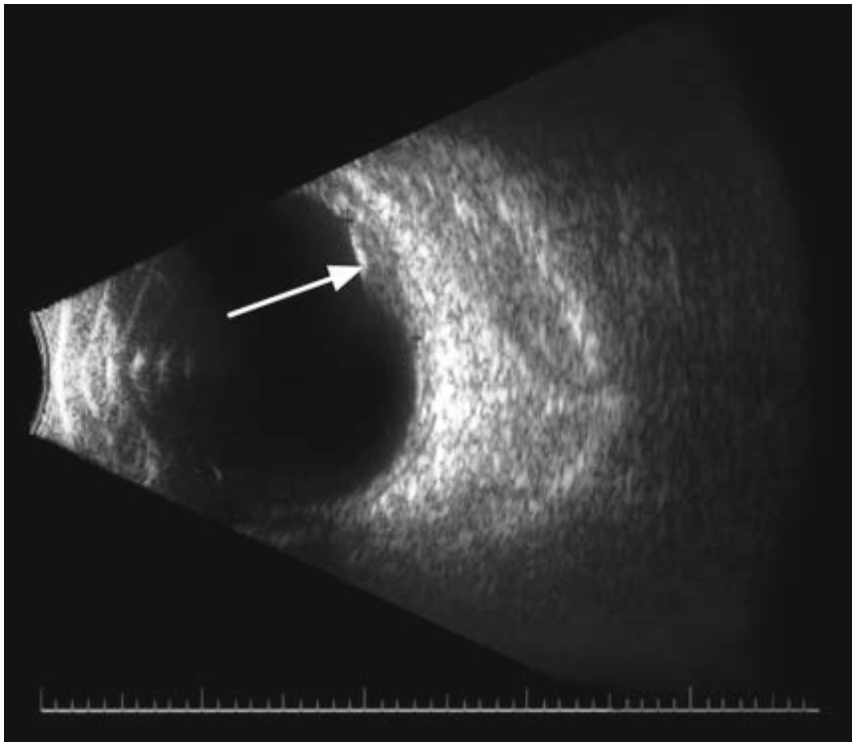


B-scan of a shallow RD

B- scan

- All B-scan probes have a small white dot on one side of the probe near the tip.
- This indicates within which plane the transducer is sweeping back and forth.
- Can be transverse or longitudinal.
- Also marks the orientation of the image on the screen so that “up” on the screen always corresponds to the position of the white dot.
- Probe captures image in the opposite meridian, eg at 6 o’clock, 12 o’clock is captured

B- scan

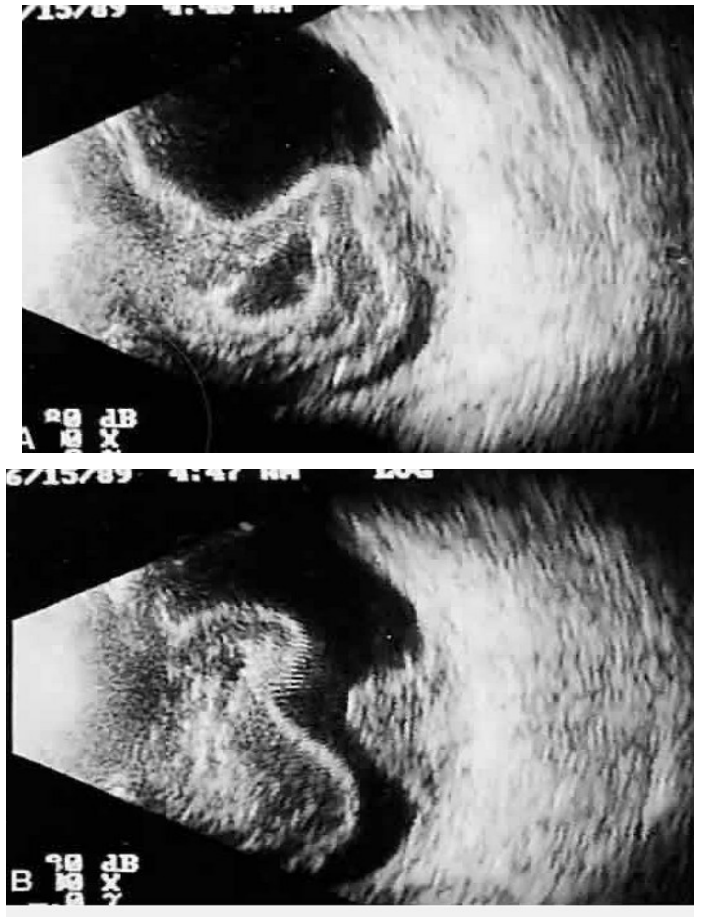


B- scan

- Echoes are converted into dots with brightness intensity proportional to echo amplitude.
- High amplitude echoes appear hyperechoic (white), absent echoes; anechoic (black)
- Eg Retina is hyperechoic, vitreous; anechoic.
- B-scan uses real time, gray scale, and three dimensional thinking for interpretation

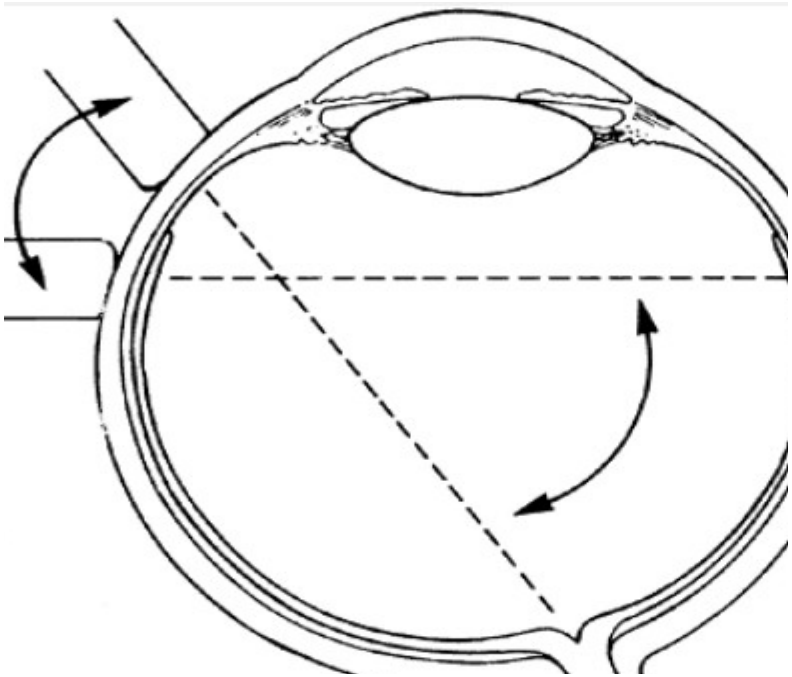
B scan

- Real time refers to the display of motion or movement during B-scan imaging.
  - Eg, the rapid movement of vitreous hemorrhage and the slower, undulating movements of a fresh RRD
- Grayscale refers to the variable gray tone of display echoes.



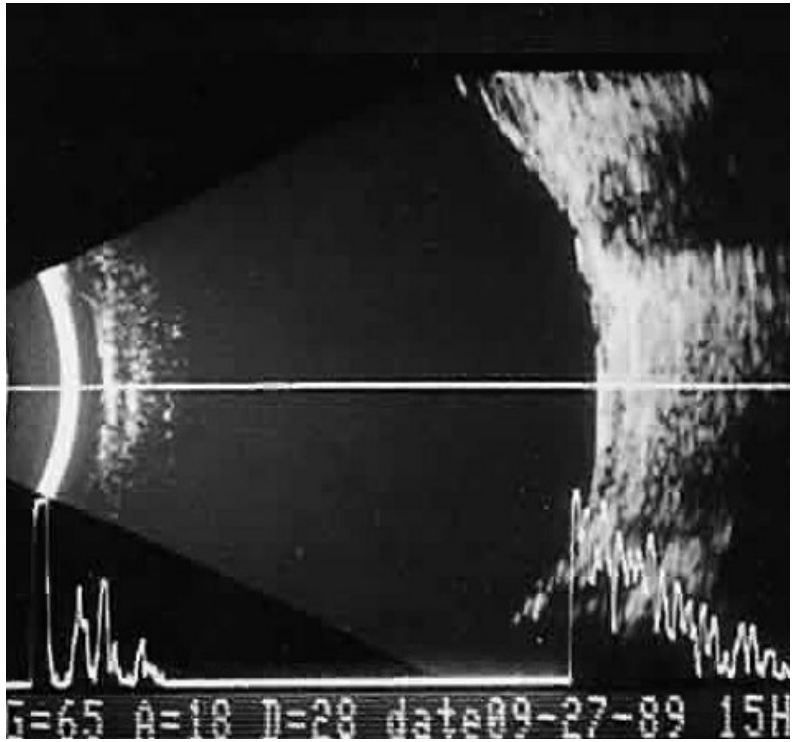
B-scan

- Three dimensional thinking is mentally creating an image of the eye being scanned by fusion of the two-dimensional images produced.
- Probe positions are chosen to avoid passage of the examining beam or returning echoes through the artifact-inducing lens system



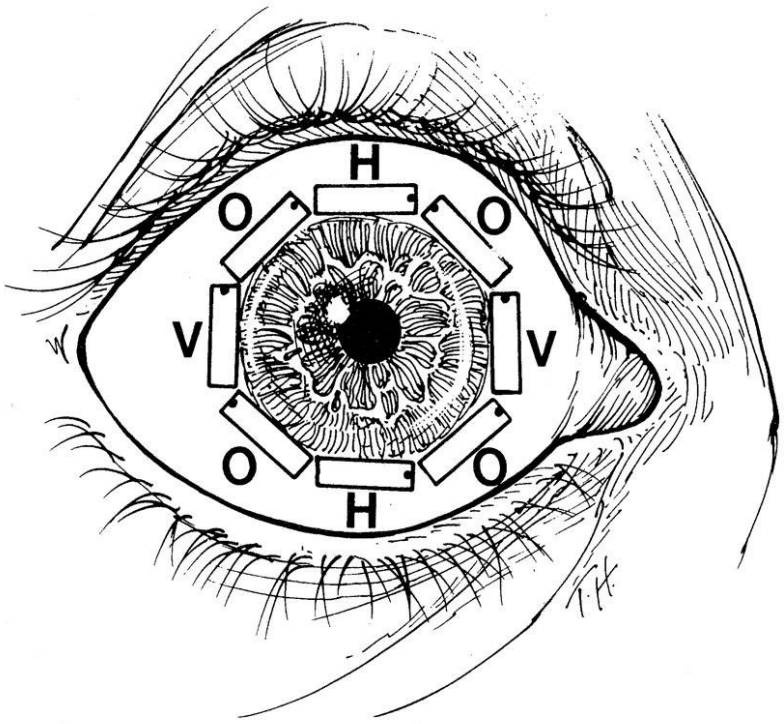
A and B-scans

- A-scan may be performed independently of B-scan.
- Overlaps of information from A-scan and B-scan are for adequate ultrasound interpretation.
- Instruments are available that present B-scan and A-scan images simultaneously.



Examination

- Patient in a horizontal position, asked to look straight towards the ceiling
- Scanning done directly on the globe with topical anaesthesia and methylcellulose.
- The globe is quickly scanned in the 8 meridians while the patient is asked to look in those directions.



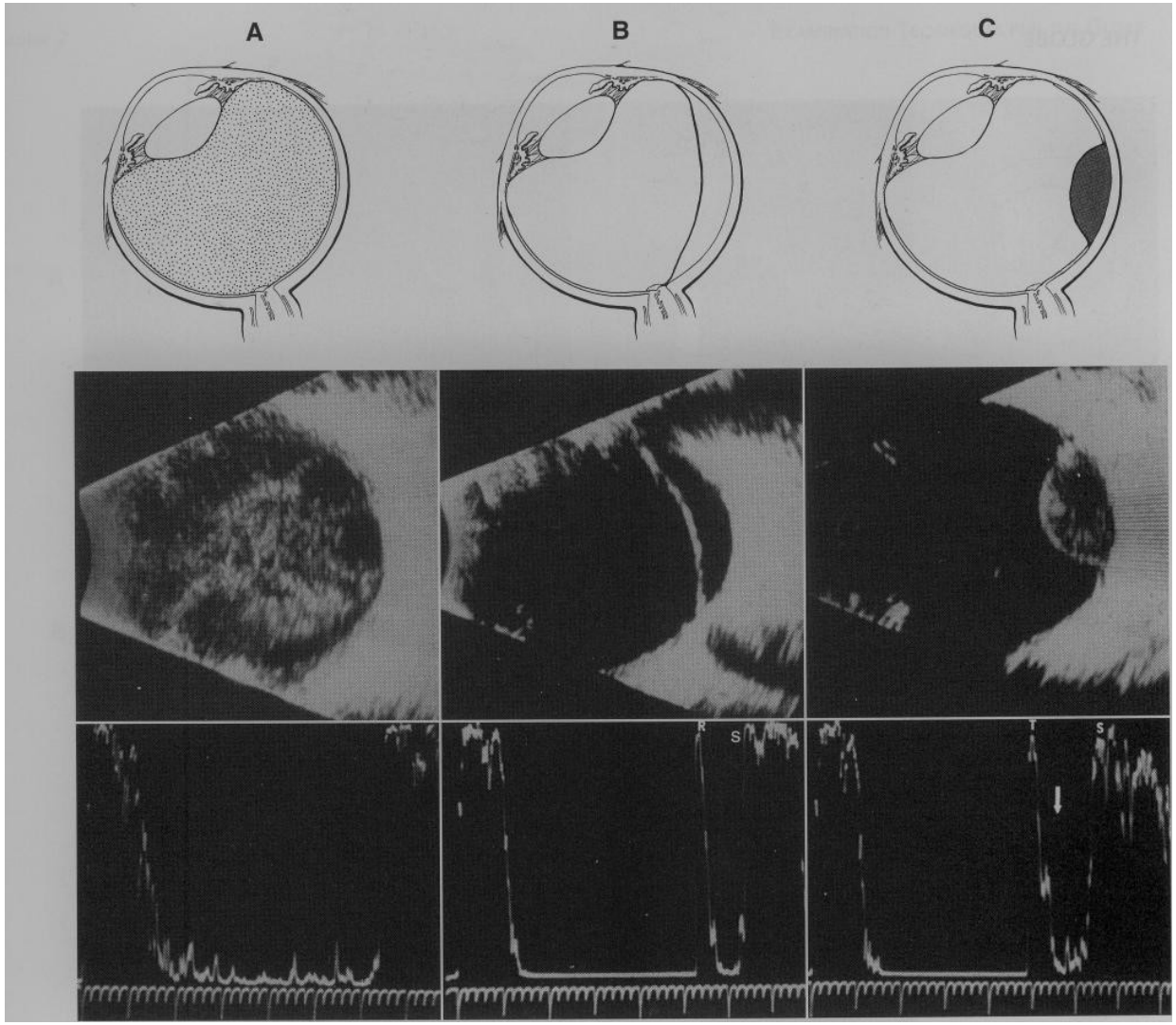
Examination

- The patient is then asked to look straight ahead at the ceiling while vertical and horizontal (axial) scans are taken of the posterior pole.
- The vitreous cavity is observed for sound reflections above the baseline while simultaneously watching the fundus for irregularities of the normal smooth convex shape.
- Any abnormalities detected during the initial screening are studied in greater detail using the longitudinal and transverse B-scan positions.

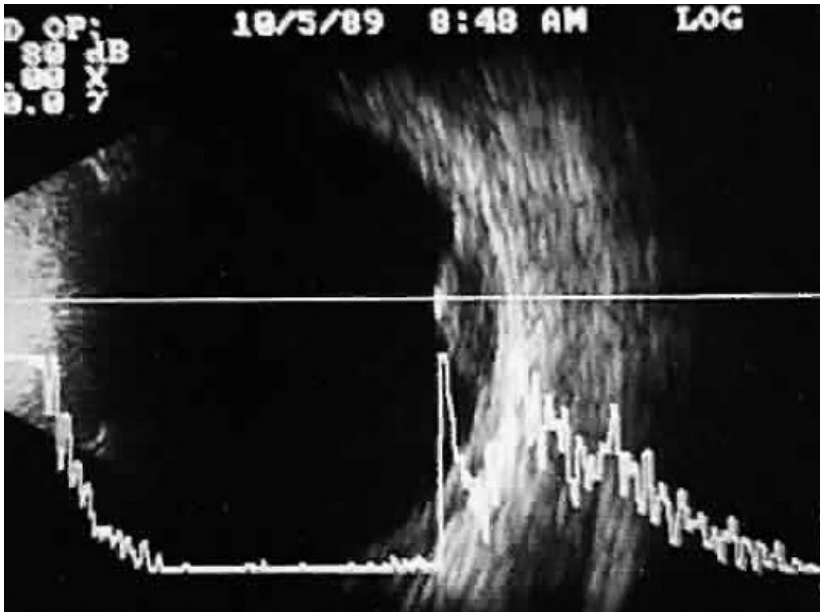
Examination

- The A-scan is then applied to the eye and a brief screening scan may be performed in the 8 meridians as a double check on the B-scan
- Usually sufficient to direct the A probe to the abnormality detected on the B-scan examination.
- It is very important to maximize perpendicularity to the lesion with the A-scan.

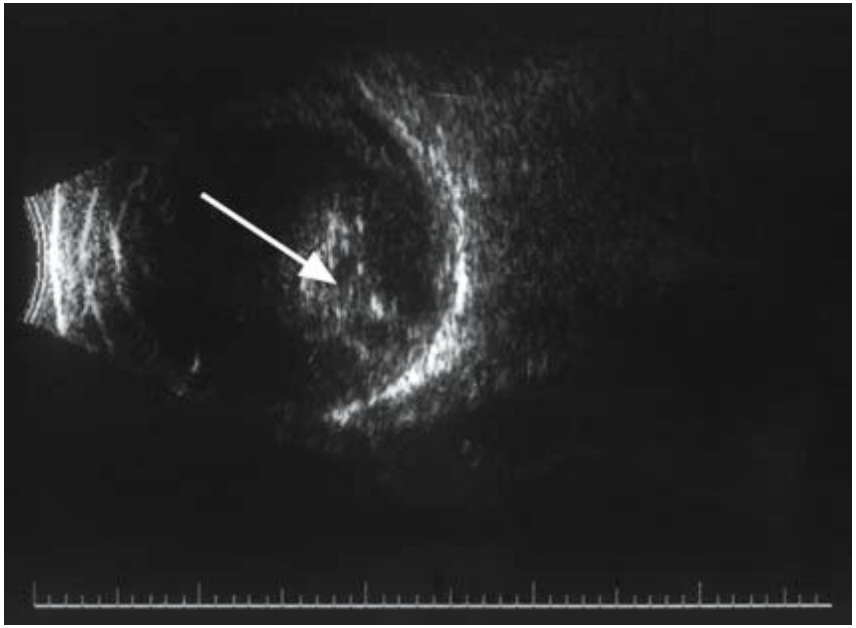
Examination



Clinical Applications : Tumours

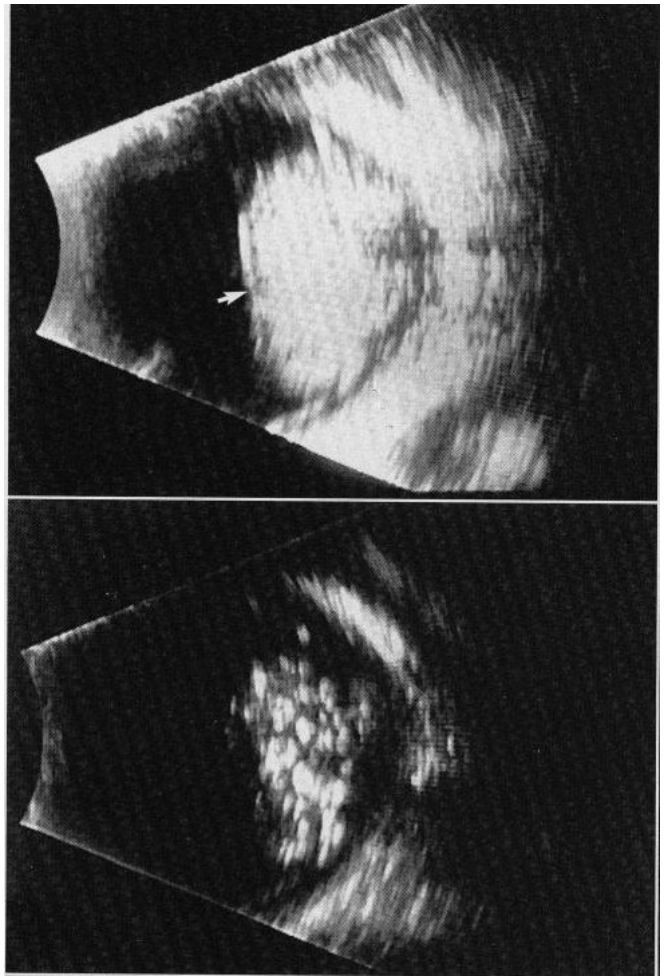


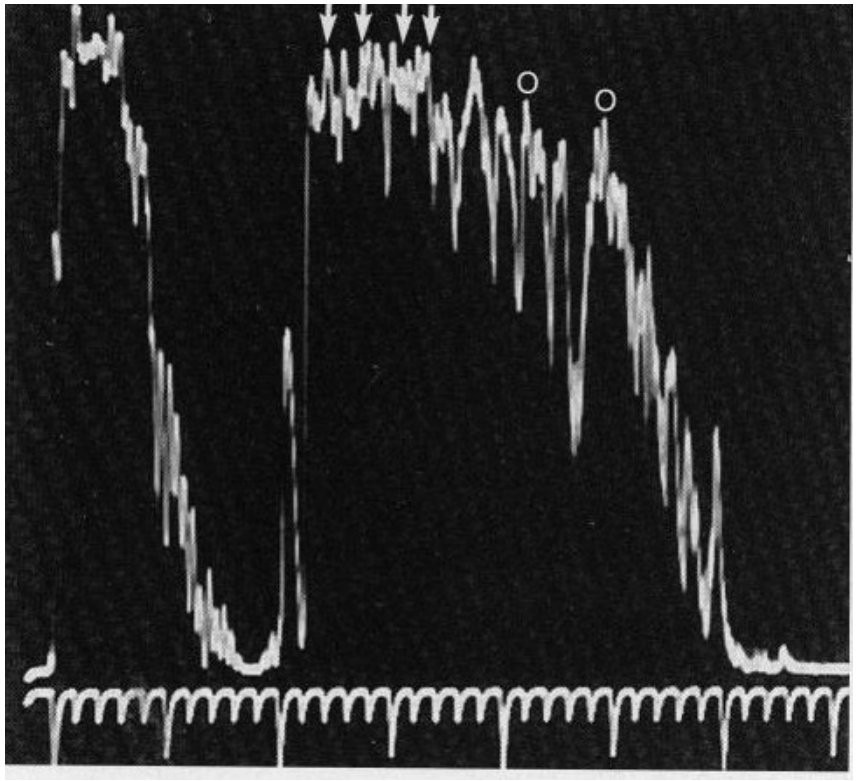
Choroidal malignant melanoma



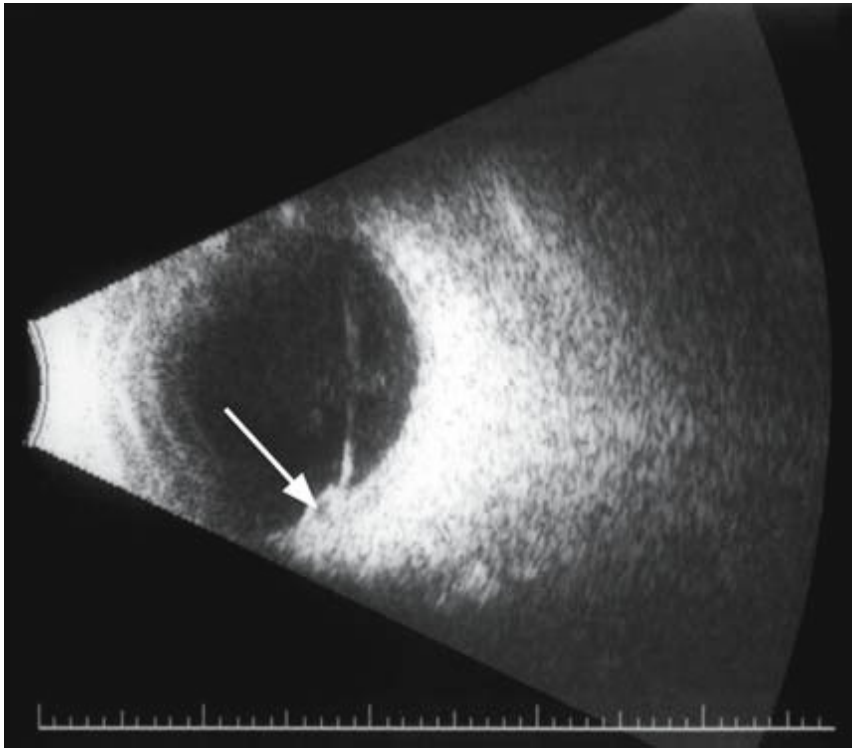
Retinoblastoma

Retinoblastoma

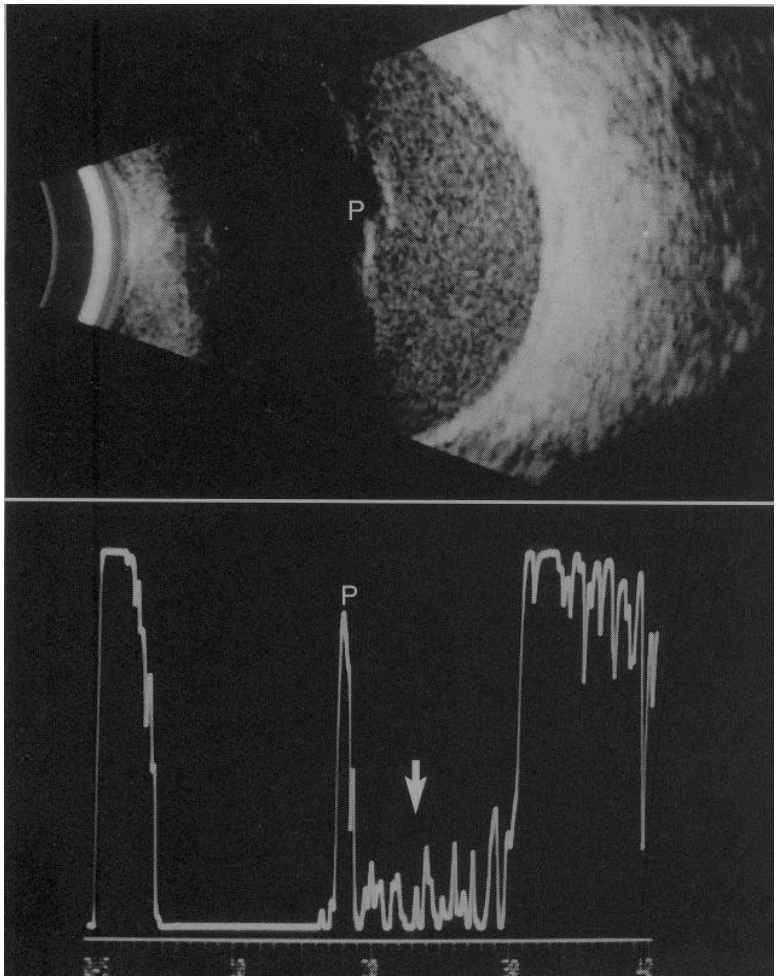




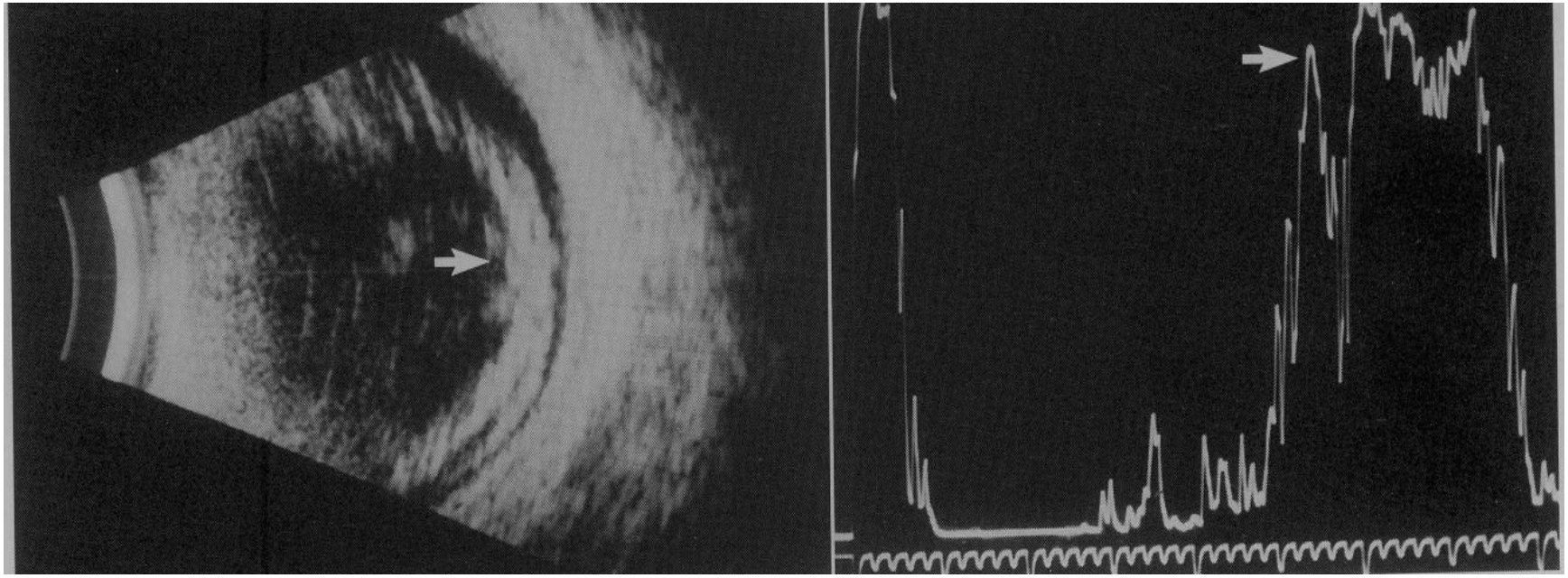
Posterior Vitreous Detachment and Retinal Detachment



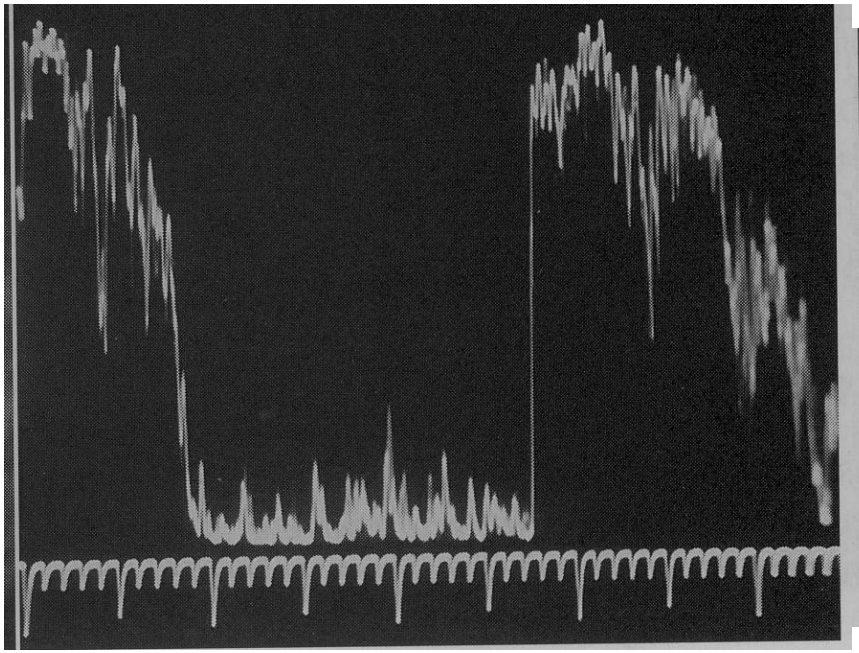
Subhyloid vitreous haemorrhage

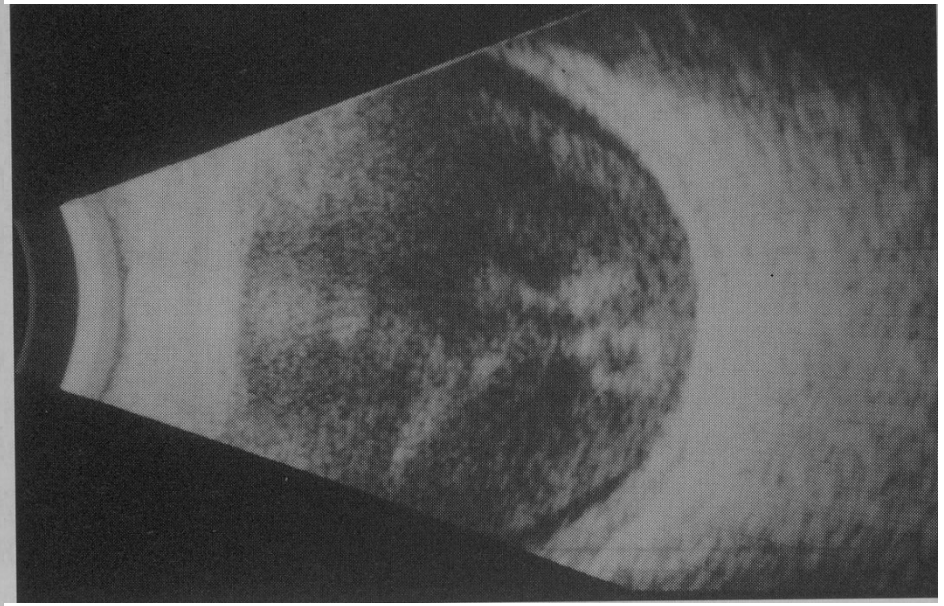


Vitreous haemorrhage

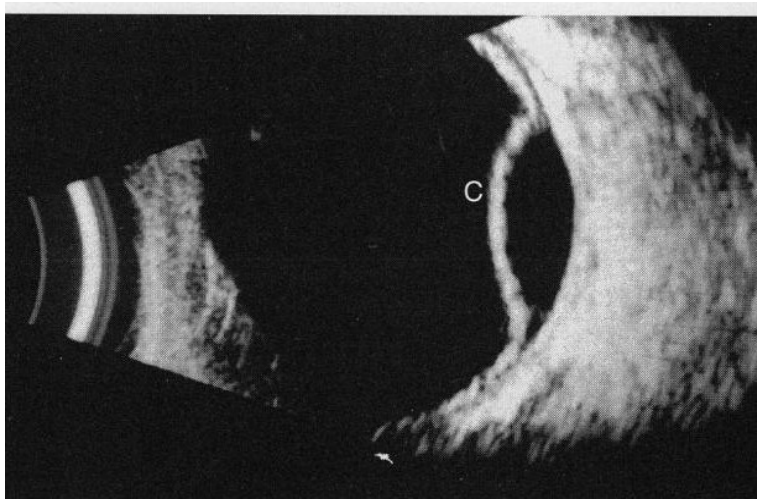


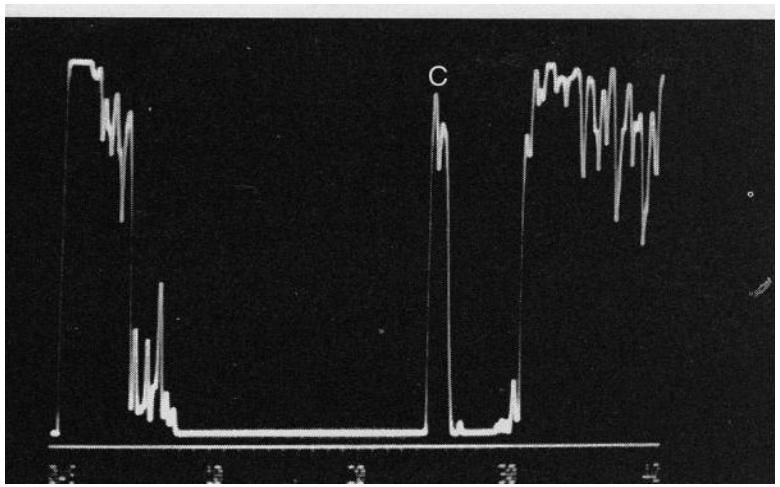
Endophthalmitis

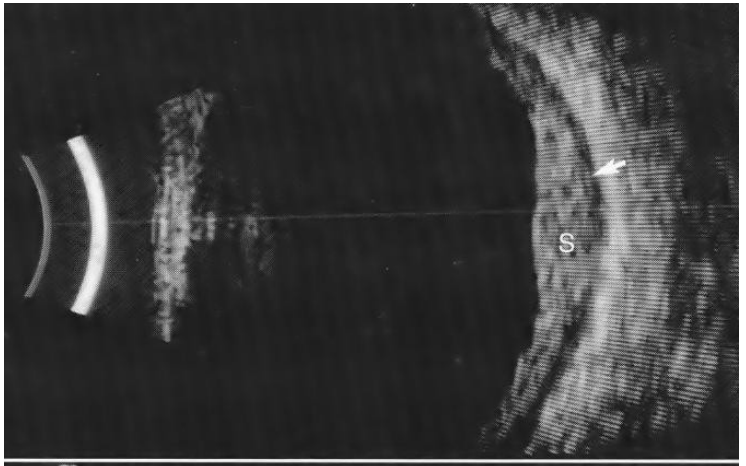


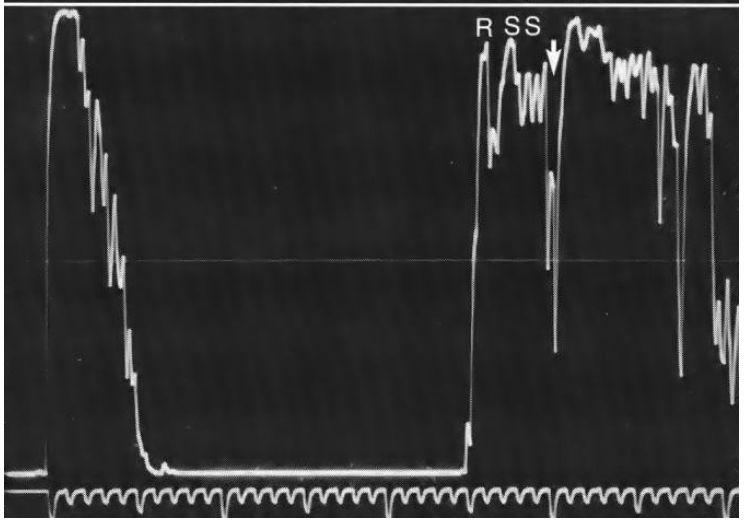


Choroid detachment and Sclerritis

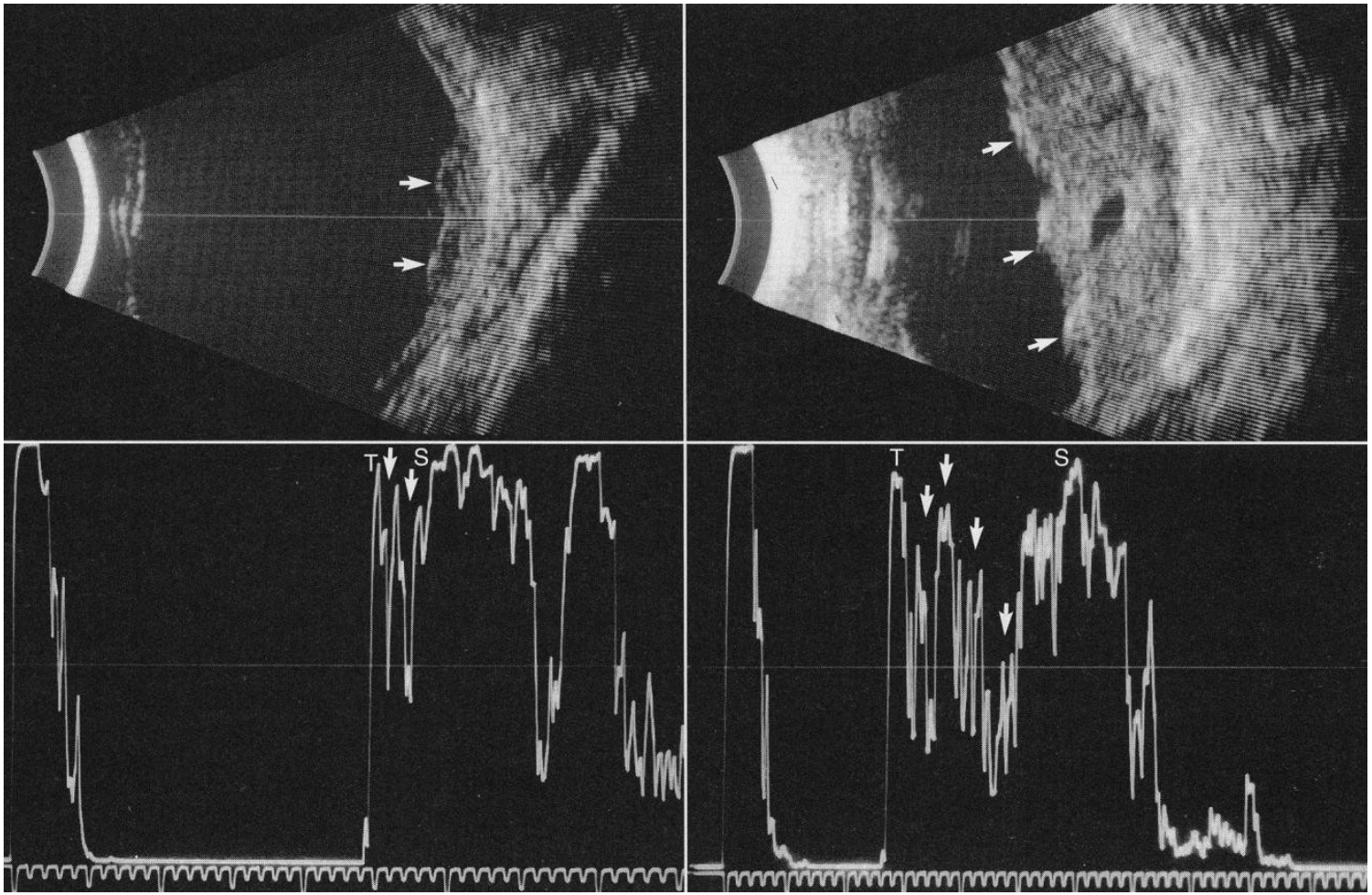




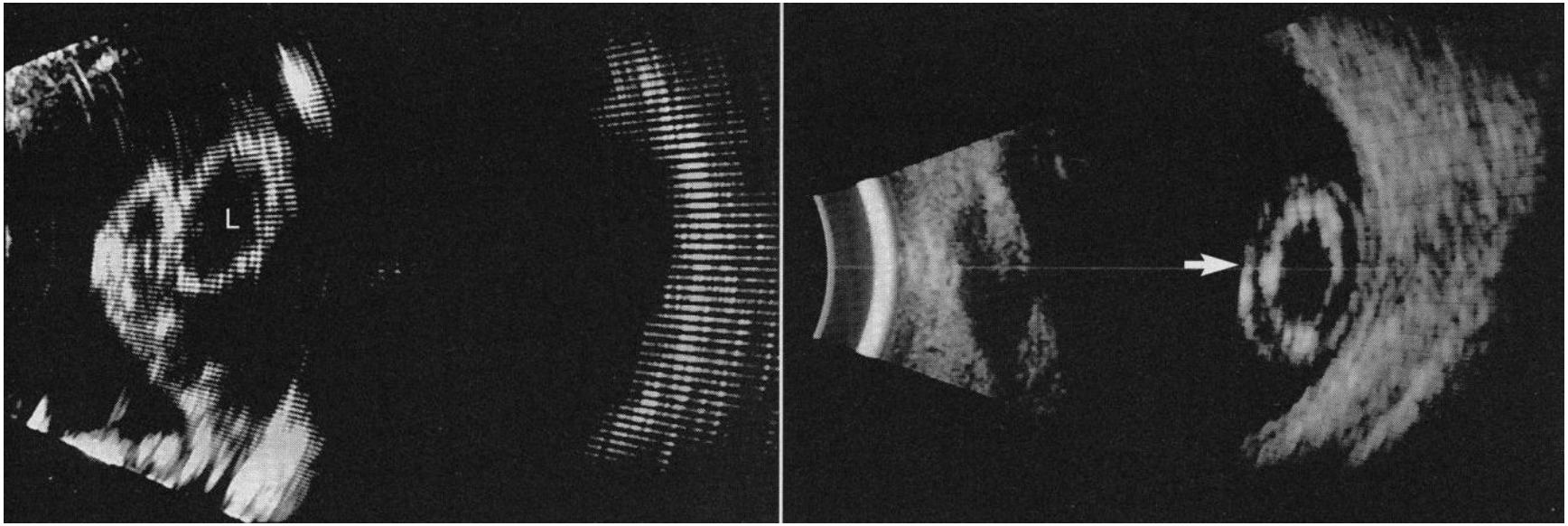




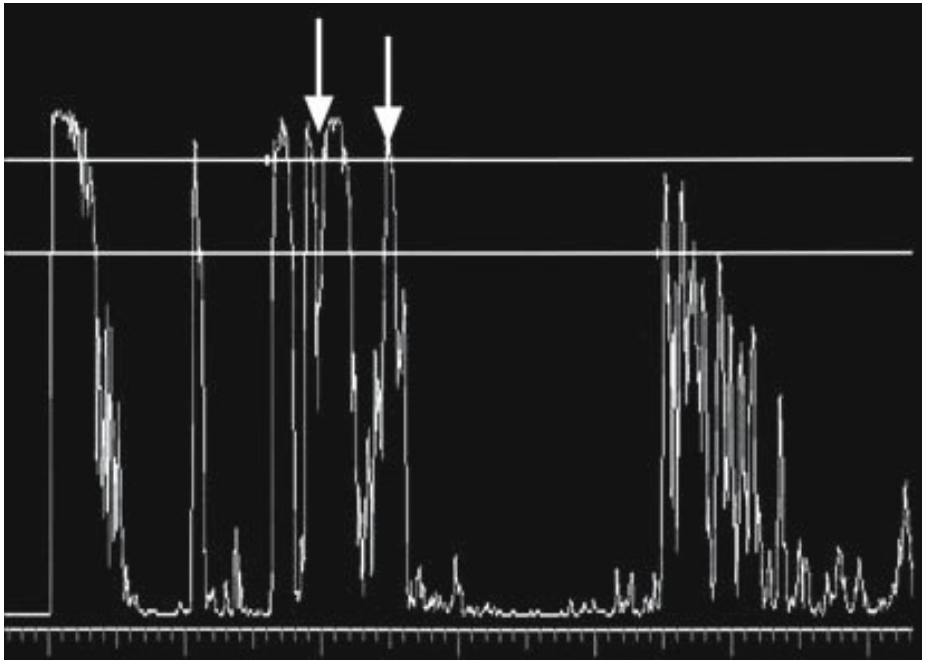
Metastatic carcinoma

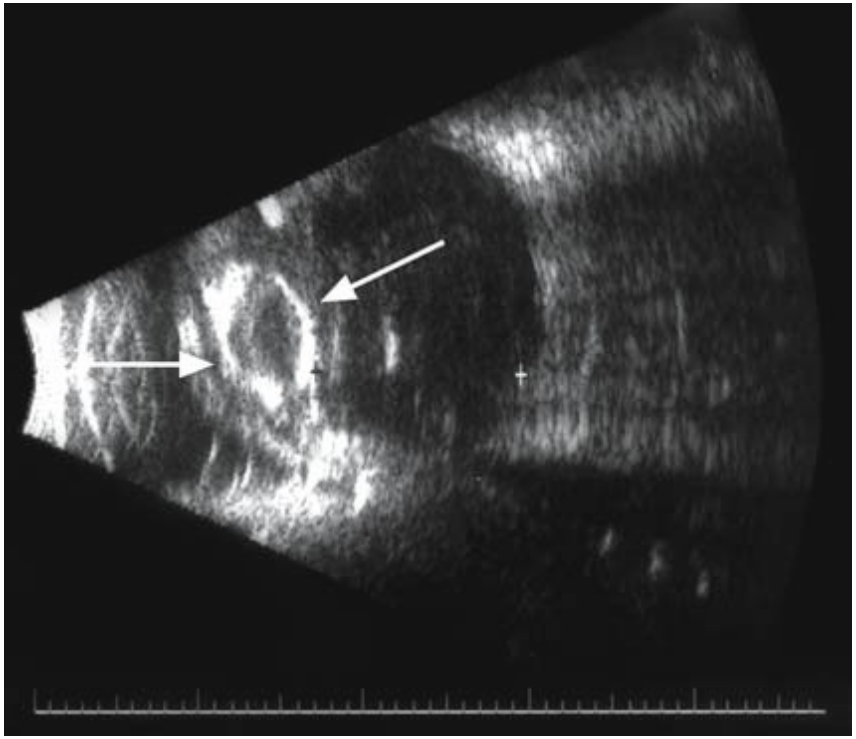


Trauma

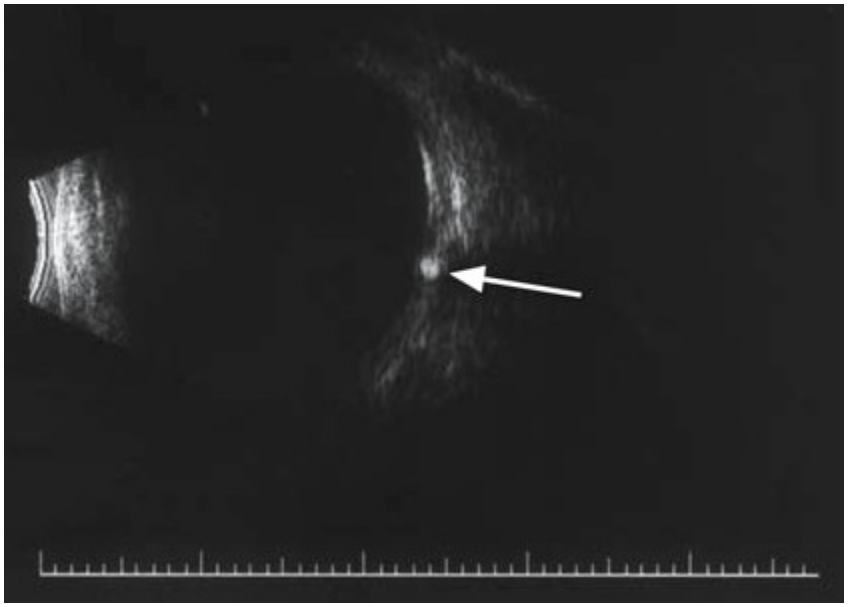


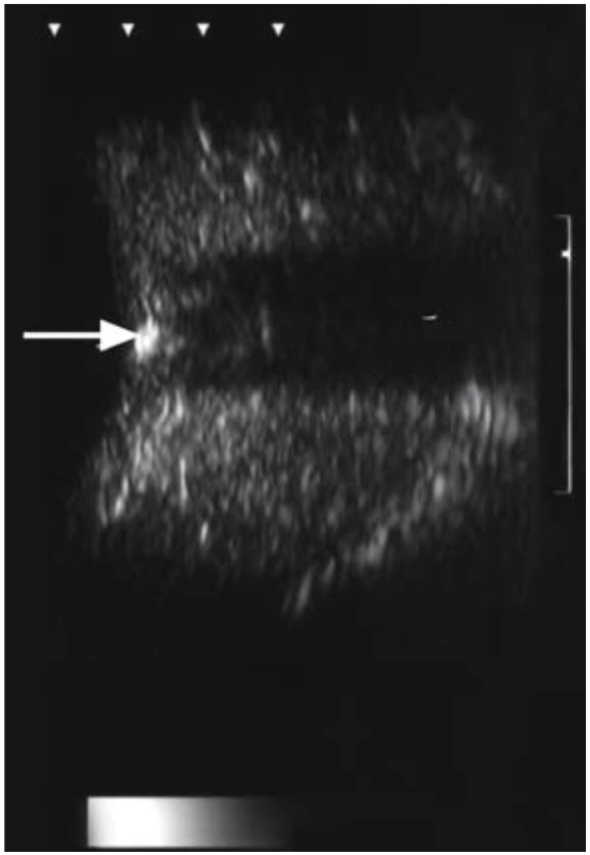
Intumuscent lens



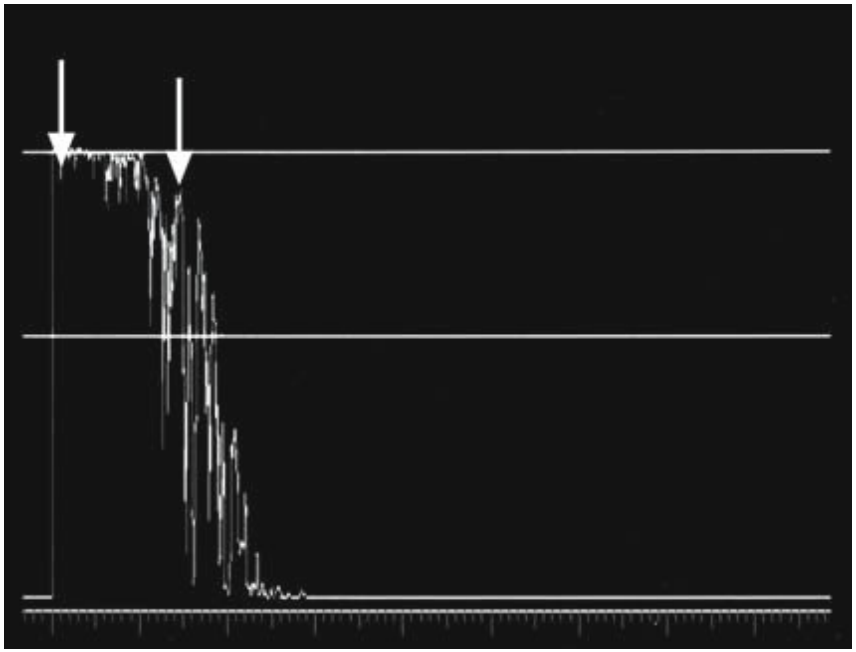


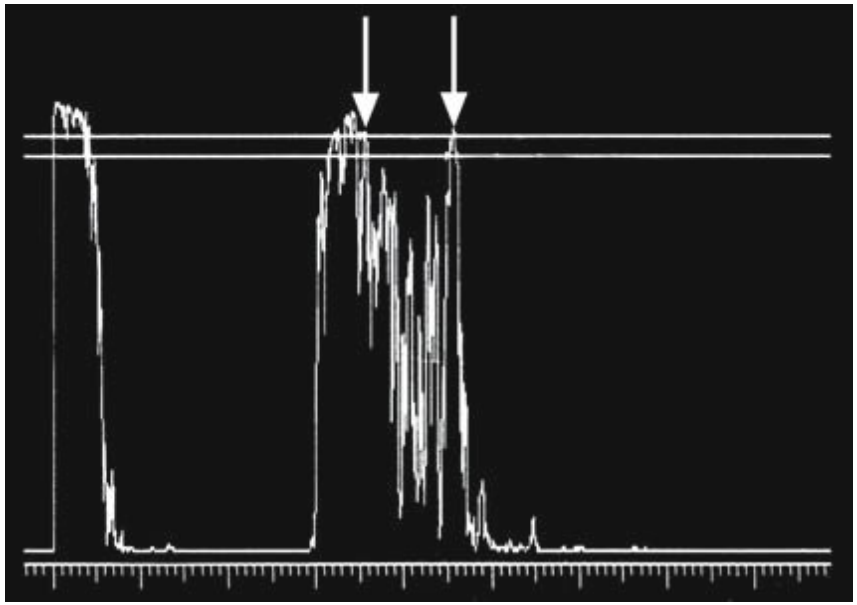
Optic disc drusen and embolic material in CRA





Lacrimal gland

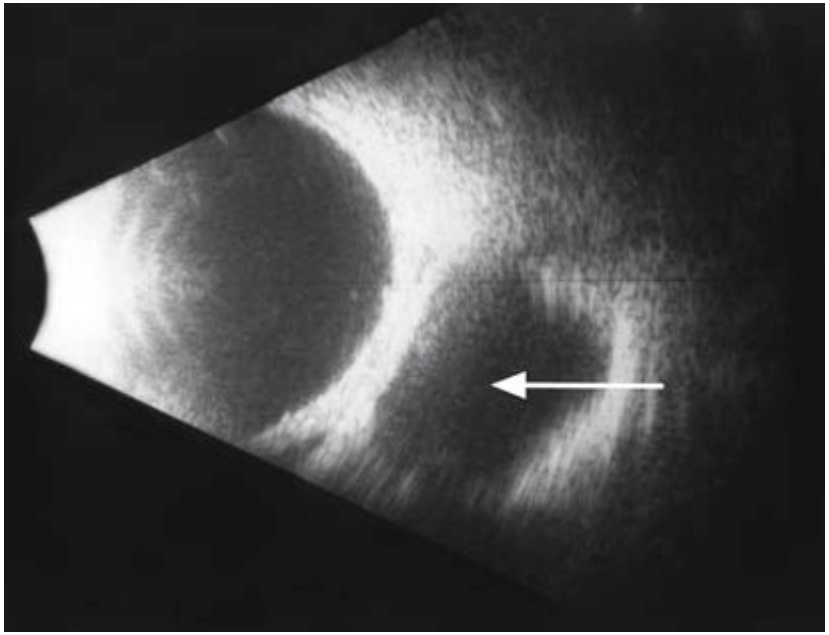




Lacrimal gland

extraocular muscle involved in Grave’s dise

Orbital masses



References

- Clinical Ophthalmic Radiography, a case study approach by Roger P. Harrie
- Duane’s Foundations of Clinical Ophthalmology, 2007 edition.
- WWW.

Thank you