



B-scan Interpretation

Elizabeth Affel, MS, OCT-C
OPS 2011 Orlando

Financial Interest



The speaker acknowledges the help of Gus Kohn, Ellex Innovative Imaging
And Chang Cheng, Accutome

Ultrasound physics

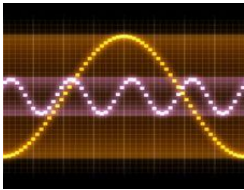


- Frequencies
- Transducers

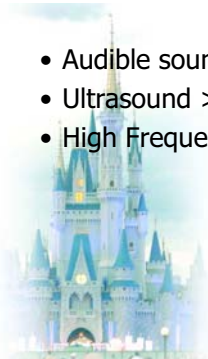


Ultrasound physics

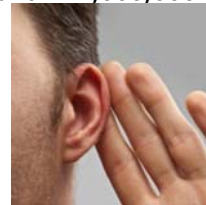
- Frequency (Hz)= cycles per second
- Penetration decreases as frequency increases
- Resolution increases as wavelength decreases



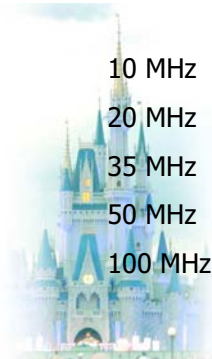
Ultrasound



- Audible sound 20-20,000 Hz
- Ultrasound > 20,000 Hz
- High Frequency Ultrasound > 1,000,000



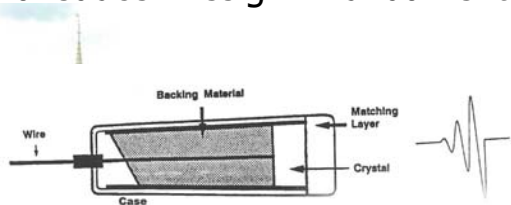
Frequencies



- 10 MHz globe and orbit
- 20 MHz cornea to posterior lens
- 35 MHz cornea to lens equator
- 50 MHz cornea to anterior lens
- 100 MHz cornea



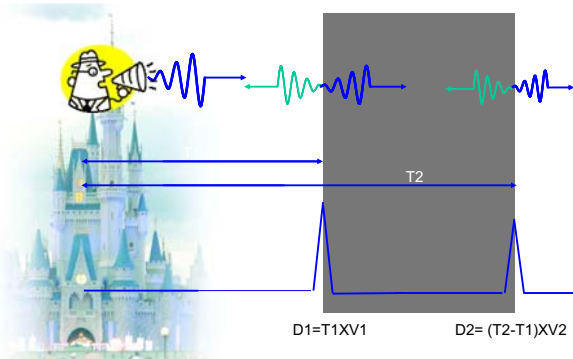
Transducer Design - Fundamentals



Pulser / Receiver System
Courtesy of Sidney Edelman, PhD

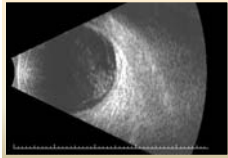
Factors Influencing Signal

- Angle of sound beam
- Relative difference between tissues
- Size and shape of interfaces



Acoustic Interface

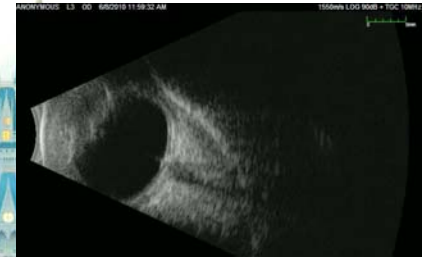
- Boundary between two media of different acoustic impedance
 - Reflection, Transmission and Refraction



Exam Techniques

- Kinetic (Dynamic)
 - Probe moves, eye stationary
 - Eye moves, probe stationary
- Static
 - probe stationary, eye stationary

Exam Techniques Kinetic (Dynamic)



Exam Techniques Kinetic (Dynamic)

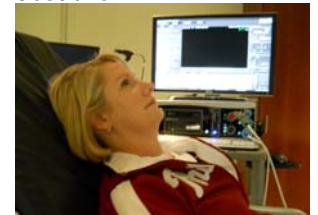


Exam Techniques Static



Examination Set Up

- Reduce distractions
- Position ultrasound unit
- Explanation of procedure
- Clean probe



Coupling Gel



Exam Techniques

- Disinfect probe tip
- On globe (preferred)
- On Lid (when needed)
- Probe marker = top of display
- Adjust gain to improve resolution
- Place probe opposite area of interest



Exam Techniques

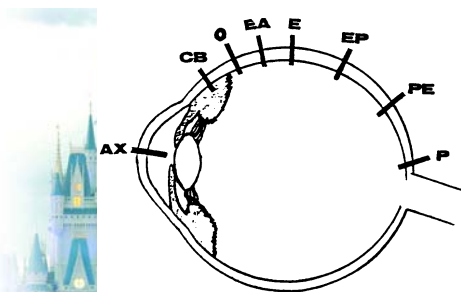
- Label images by area examined
 - Transverse
 - Center of all clock hours in image
 - Indicator of posterior, equator, anterior
 - Longitudinal
 - Clock hour being examined
 - Axial
 - HAX = Horizontal, VAX = Vertical
 - Oblique with clock hour and "AX"
- Patient looks away from probe
 - Except axial scans



Exam Techniques

- Transverse
 - Scan plane traverses several clock hours
 - “Quadrant” exams (Superior/Inferior/Nasal/Temporal)
 - Image posterior pole first (Begin with Optic Nerve)
 - Sweep “Acoustic Section” posterior to anterior
 - Observe/Measure lateral extent of pathology
- Labeling
 - Horizontal = 12P, 12PE, 12E, 12EA, same for 6:00
 - Vertical = 3P, 3PE, 3E, 3EA, same for 9:00

Exam Techniques



From Sandra Frazier Byrne, RDMS, ROUB

Exam Techniques

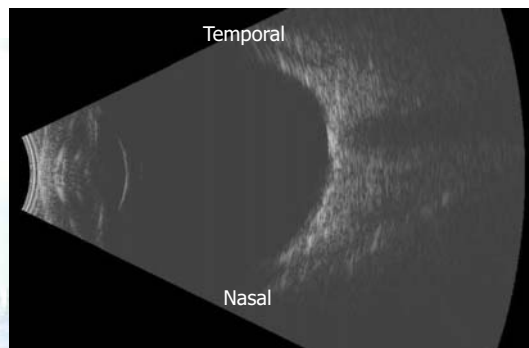
- Longitudinal (Radial)
 - Image one clock hour at a time
 - Anterior to Posterior orientation of display
 - Top of display = Anterior Periphery
 - Bottom of display = Posterior (Optic Nerve)
 - Probe marker always toward limbus
 - **BEST** for locating peripheral tears
 - **BEST** for documentation of macula
 - **BEST** for differentiation of hyaloid versus hyaloid with heme
 - Observe/Measure anterior-posterior extent

Exam Techniques

- Axial
 - HAX = Horizontal, VAX = Vertical, 10AX, 2 AX
 - Oblique with clock hour and “AX”
 - Patient looks straight ahead
 - Gentle, extra gel
 - Anterior to Posterior orientation of display
 - Left of display = Anterior Segment
 - Right of display = Posterior (Optic Nerve)
 - Probe marker always nasal or UP
 - Observe/Measure anterior-posterior extent
 - Use to recheck A scan measurements



B-scan Echo Patterns

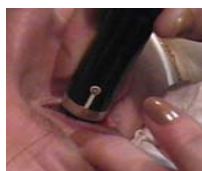


Normal Eye - Horizontal Axial View

Probe Orientation

Extremely important !
Mark on B-scan probe
= Top of display

Performing Vertical Transverse Scans



3P

Beam Directed
Posteriorly



3E

Beam Directed
Toward Equator



3EA

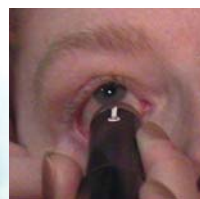
Beam Directed
Anteriorly

Performing Longitudinal Scans

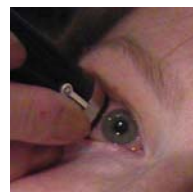


L9

(LMac)



L1



L3

Probe Marker = Top of Image

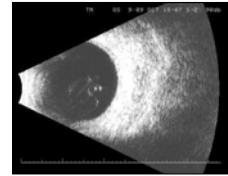
- Horizontal Transverse
 - Marker Nasal
- Vertical Transverse
 - Marker Superior
- Oblique Transverse
 - Marker as “Up” as possible
- Longitudinal
 - Marker toward clock hour being examined
- Axial
 - Center posterior lens echo
 - Horizontal documents visual pathway

The Use of Gain in Exams

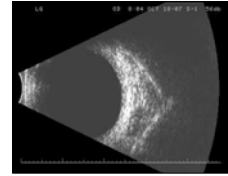
- Frequently Adjusted Throughout Exam
- High Gain = Increased Sensitivity
 - Hemorrhage
 - Synerisis
 - Posterior Hylaoid
 - Inflammatory Cells
- Low Gain = Increased Resolution
 - Layers of Membranes; Hylaoid, Retina, Choroid
 - Retinal Breaks and Tears
 - Vascularity within Tumors
 - Macular Edema and Holes

Gain setting

High (good sensitivity)

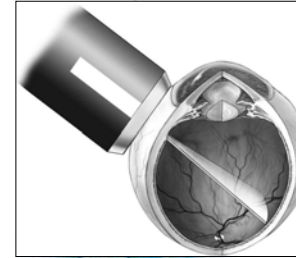


Low (good resolution)



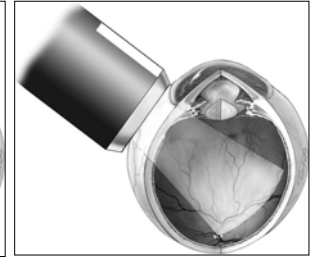
From Sandra Frazier Byrne, RDMS, ROUB

Probe Positions



Transverse Scan

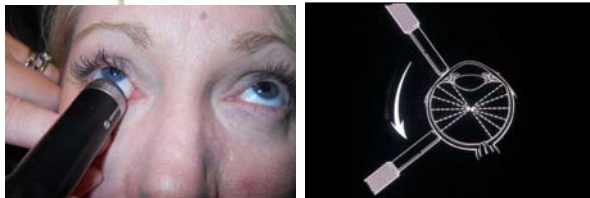
From Sandra Frazier Byrne, RDMS, ROUB



Longitudinal Scan

Screening Procedure

Patient fixates away from Probe



Shift Probe from Limbus to Fornix

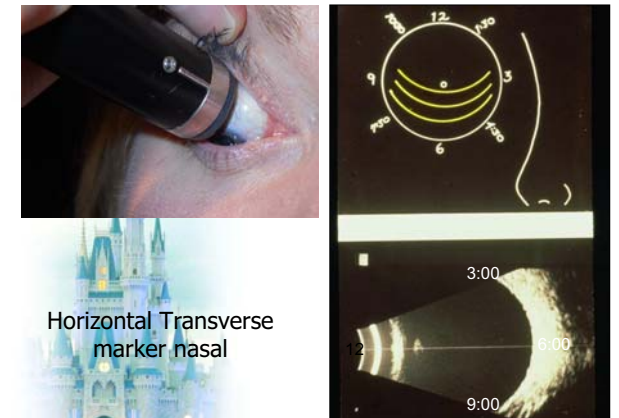
From Sandra Frazier Byrne, RDMS, ROUB



Horizontal Transverse

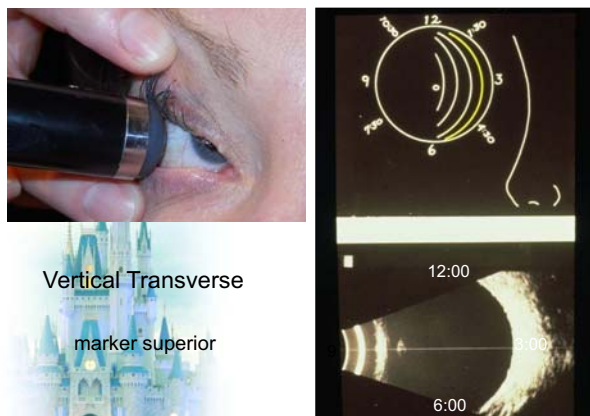
marker nasal

From Sandra Frazier Byrne, RDMS, ROUB



Horizontal Transverse
marker nasal

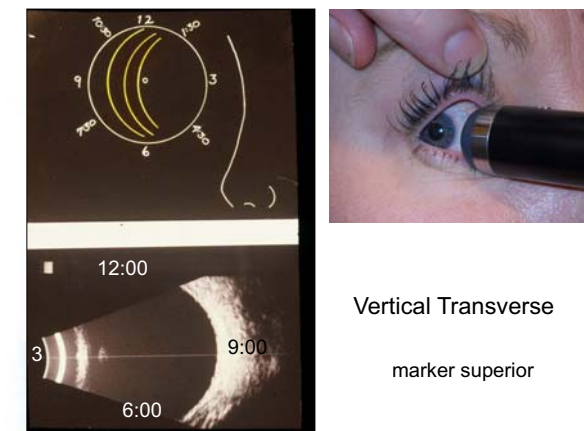
From Sandra Frazier Byrne, RDMS, ROUB



Vertical Transverse

marker superior

From Sandra Frazier Byrne, RDMS, ROUB

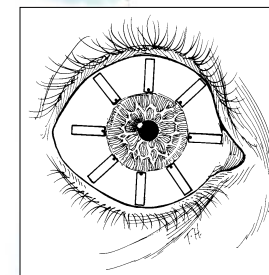


Vertical Transverse

marker superior

From Sandra Frazier Byrne, RDMS, ROUB

Longitudinal Screening
Evaluate 12:00, 3:00, 6:00, 9:00

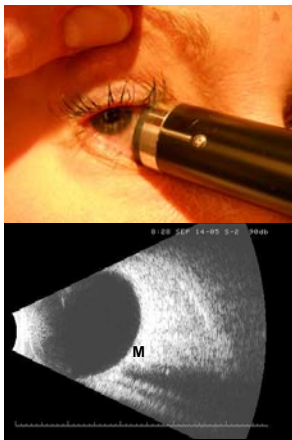
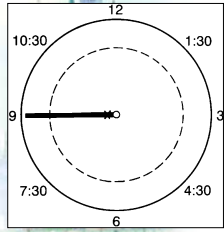


From Sandra Frazier Byrne, RDMS, ROUB



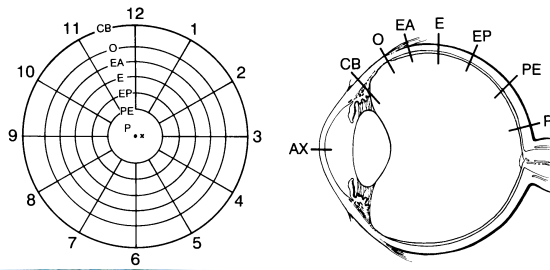
Shift: limbus to fornix to get
Optic Nerve at bottom
Rock: side to side

LMAC



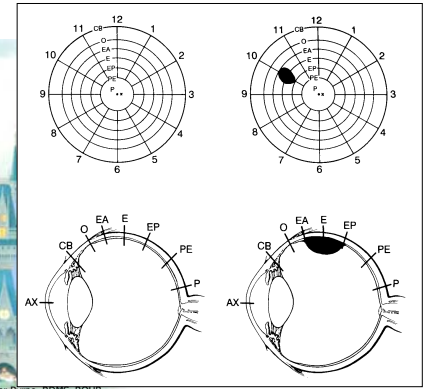
From Sandra Frazier Byrne, RDMS, ROUB

Labeling Scheme



From Sandra Frazier Byrne, RDMS, ROUB

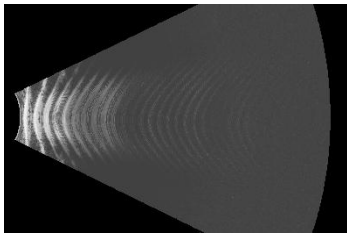
Labeling Scheme



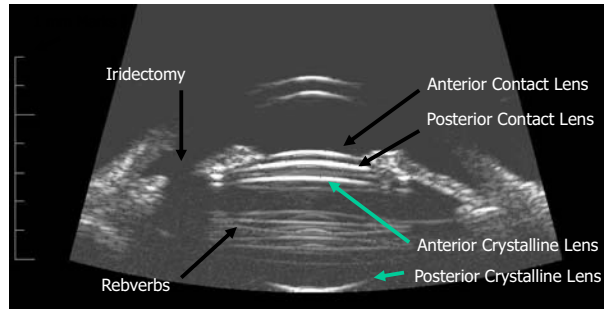
From Sandra Frazier Byrne, RDMS, ROUB

Artifacts

- Reverberation
- Reduplication
- Shadowing
- Blocking
- Reflection
- Refraction

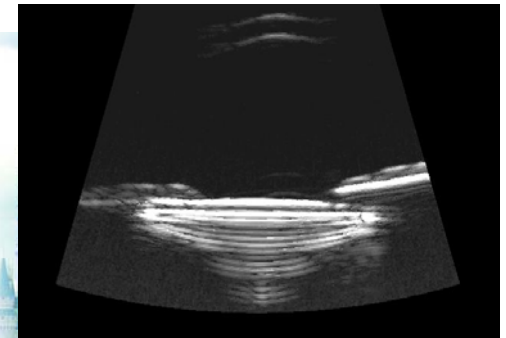


20 MHz Anterior B-scan



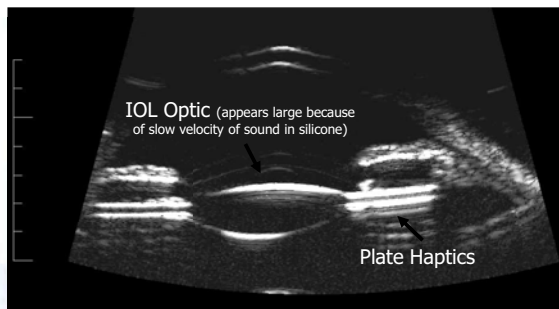
Intra Ocular Contact Lens – Correcting Hyperopia

20 MHz Anterior B-scan



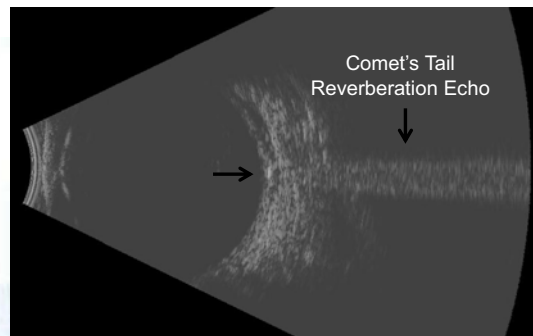
PMMA IOL

20 MHz Anterior B-scan



Silicone Plate Haptic IOL

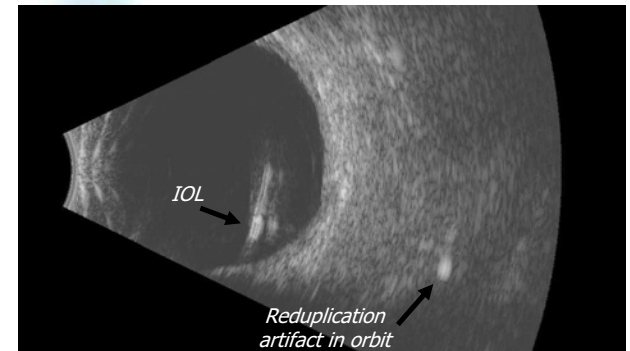
B-scan Echo Patterns



BB Imbedded in Sclera

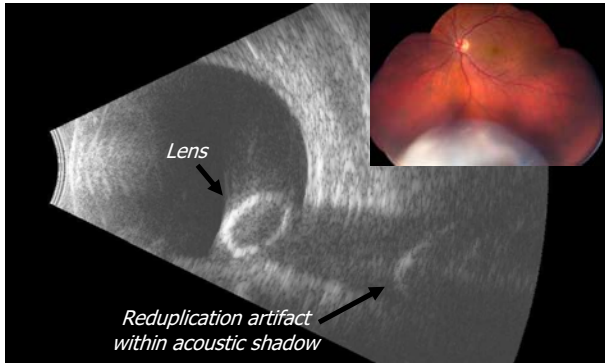
Dislocated IOL

6PE (Horizontal Transverse of 6:00 Posterior to Equator)

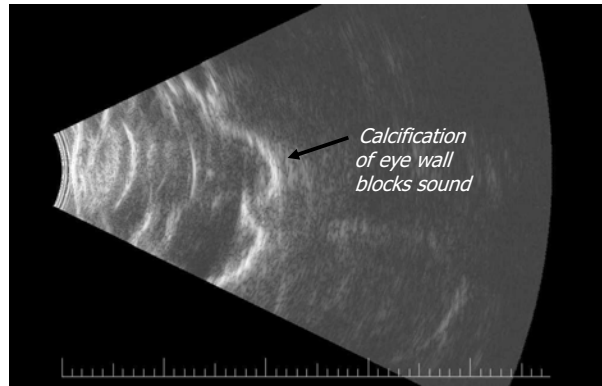


Reduplication artifact in orbit

Dislocated Crystalline Lens



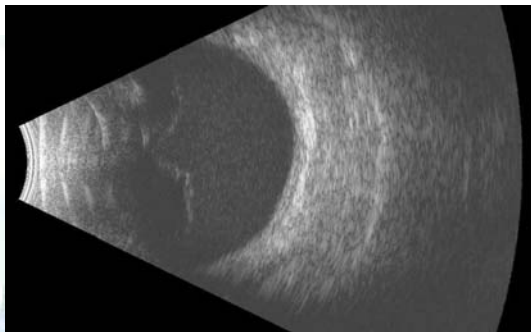
Phthisis — The End of the Line for this Patient



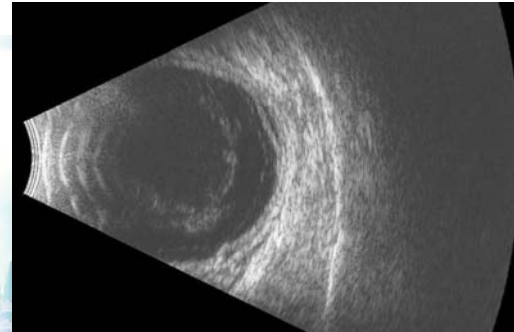
Medial Opacities

- **Vitreous hemorrhage**
 - Blood cells
 - Recent
 - Clot
- **Cataract**
- **Inflammatory cells**
 - Endophthalmitis
- **Asteroid Hyalosis**
 - Calcium soap particles

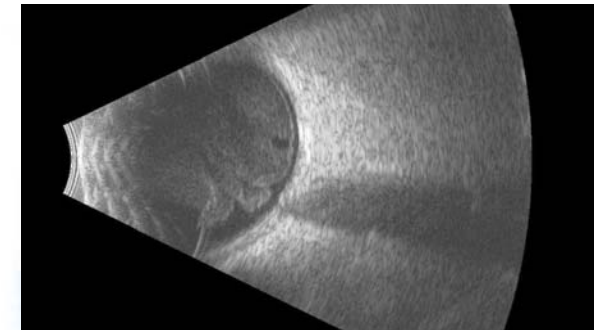
B-scan Echo Patterns



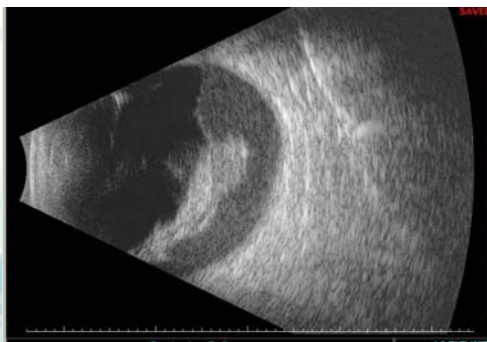
B-scan Echo Patterns



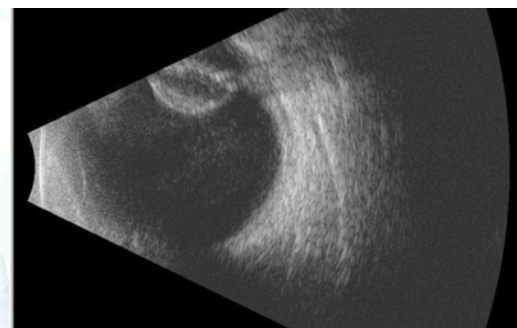
B-scan Echo Patterns



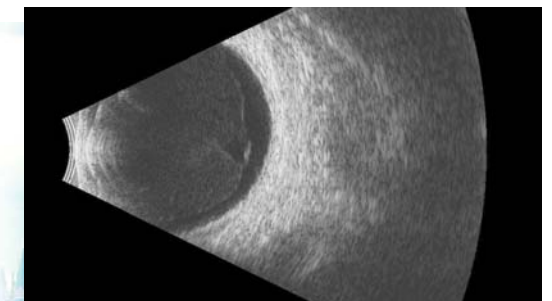
B-scan Echo Patterns



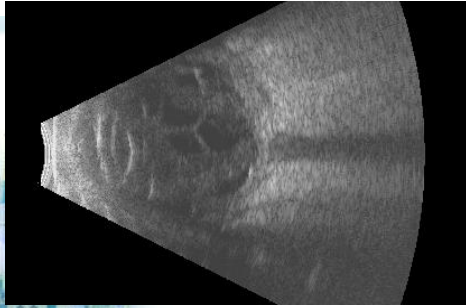
B-scan Echo Patterns



B-scan Echo Patterns



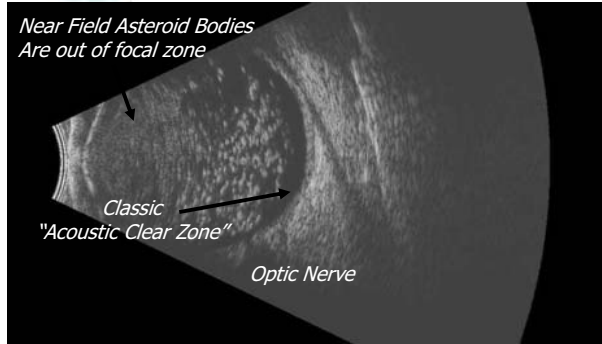
B-scan Echo Patterns



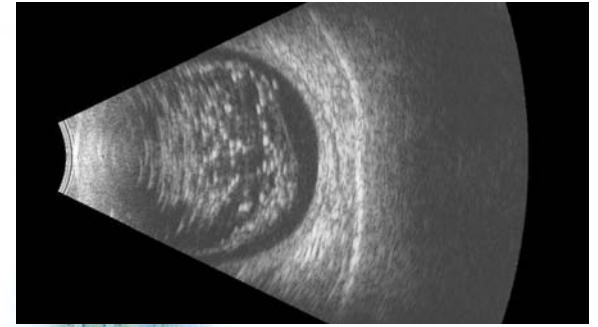
Inflammatory Cells

Asteroid Hyalosis

L9 (Longitudinal of 9:00)



B-scan Echo Patterns



Asteroid Hyalosis

Detachments

- **Vitreous**
 - Weiss ring
- **Retina**
 - Exudative
 - Rhegmatogenous
 - Tears

Detachments (cont'd)

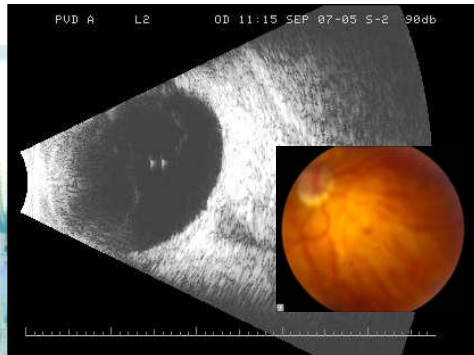
- **Choroid**
 - Scallop shape
- **Ciliary body**

Detachments



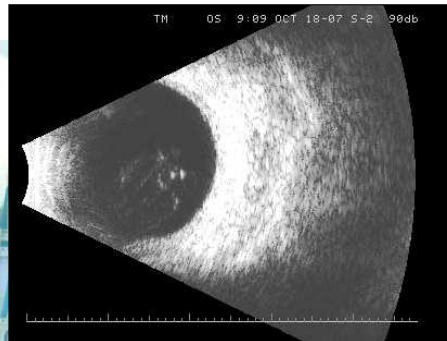
Weiss Ring - Usually shown best in Longitudinal position

Detachments



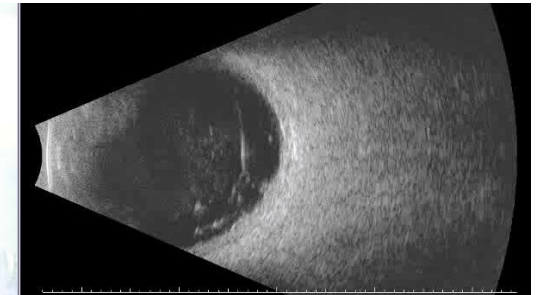
Weiss Ring

Detachments



Weiss Ring

Detachments

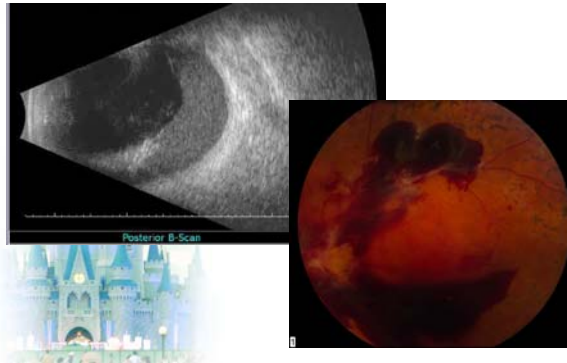


Detachments

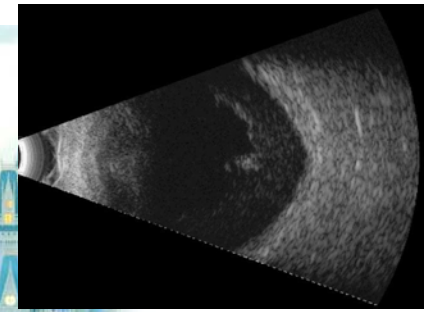


Traction Retinal Detachment

Detachments

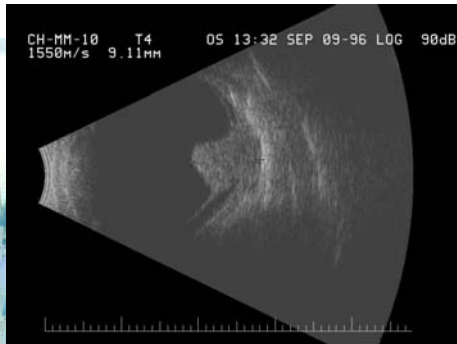


Detachments



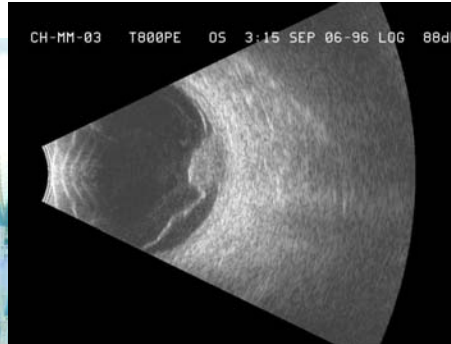
Subhyaloid Hemorrhage

Detachments



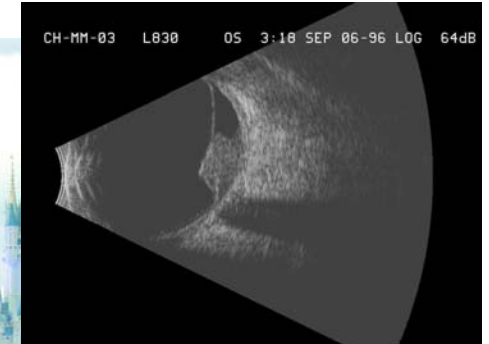
Exudative

Detachments



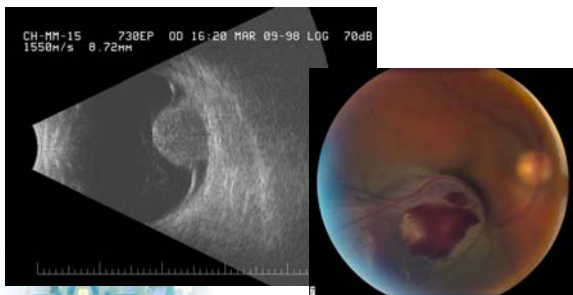
Exudative

Detachments



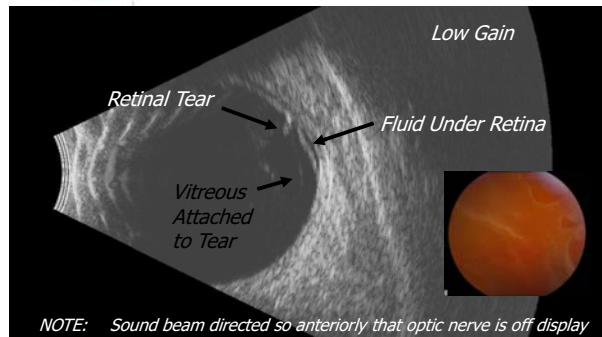
Exudative

Detachments

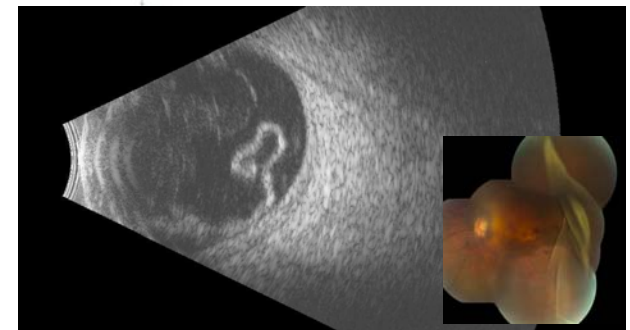


Exudative

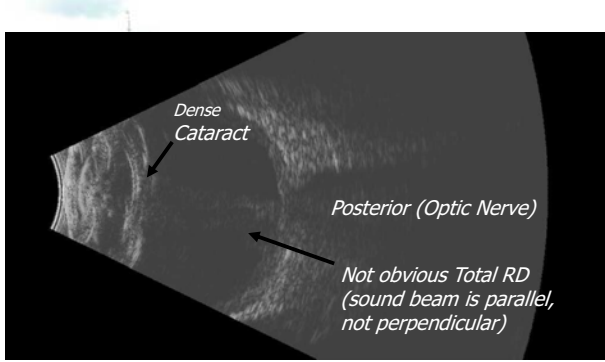
Post Dropped Nucleus (3 of 3) L10 (Longitudinal of 10:00, very anterior)



Giant Retinal Tear



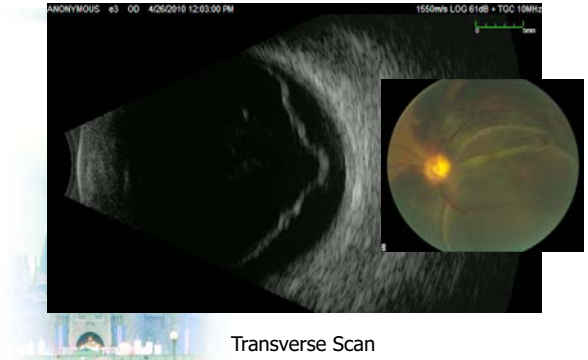
Transverse of Closed Funnel RD HAX (Horizontal Transverse – Axial View)



Retinal Detachment



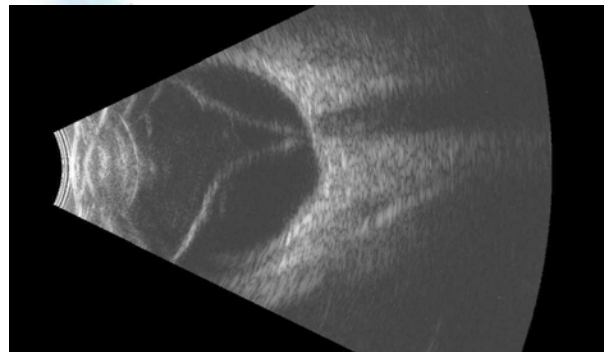
Retinal Detachment



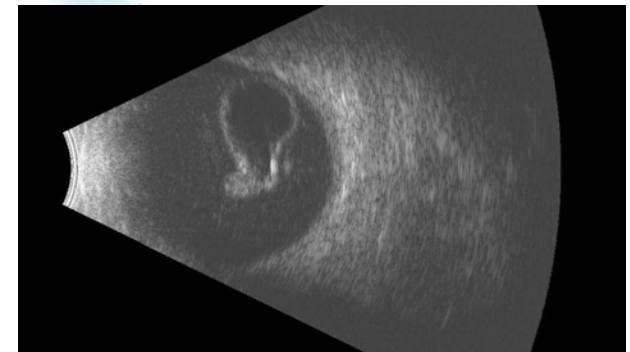
B-scan Echo Patterns



Transverse of Open Funnel RD HAX (Horizontal Transverse – Axial View)

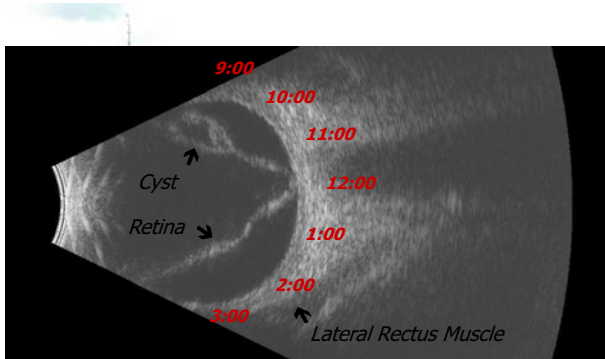


Transverse of Open Funnel RD 9E (Vertical Transverse of 9:00 at the Equator)



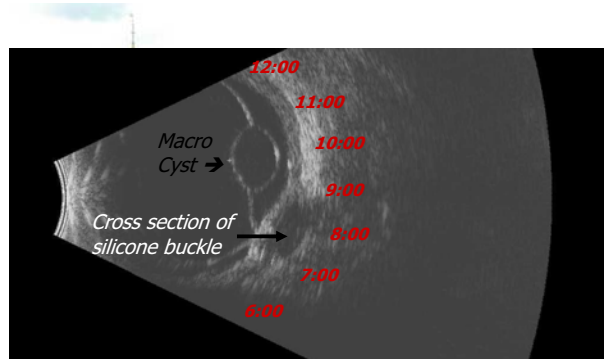
RD with Cyst (1 of 4)

12P (Horizontal Transverse of 12:00 Posterior)



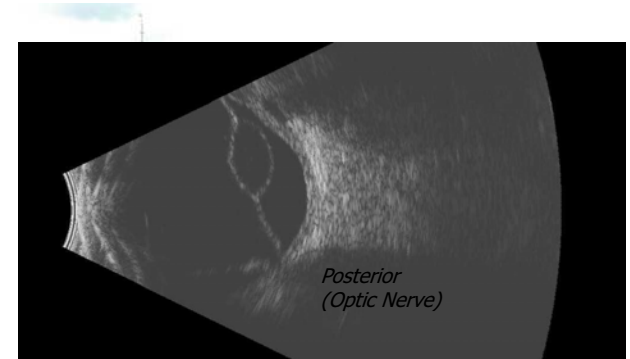
RD with Cyst (2 of 4)

9E (Vertical Transverse of 9:00 at Equator)

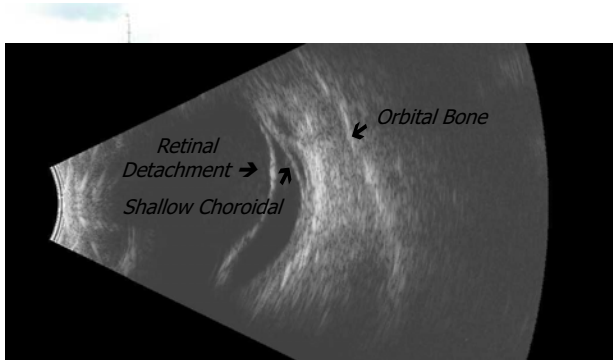


RD with Cyst (3 of 4)

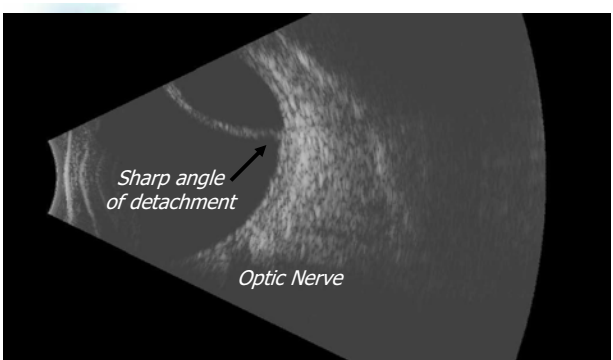
L9 (Longitudinal of 9:00)



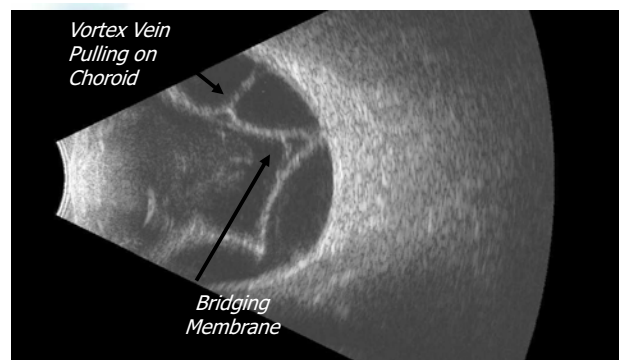
RD with Cyst (4 of 4)
L1 (Longitudinal of 1:00)



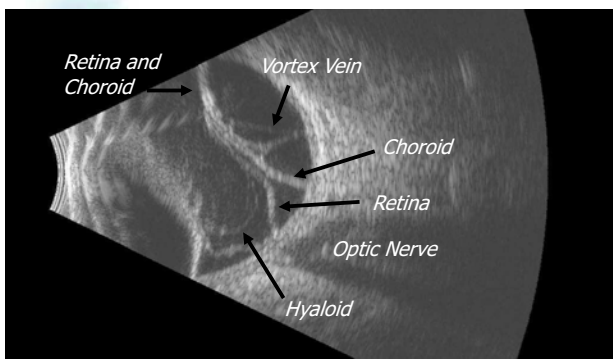
Serous Choroidal
L3MAC (Longitudinal of 3:00 Macula)



Serous Choroidal



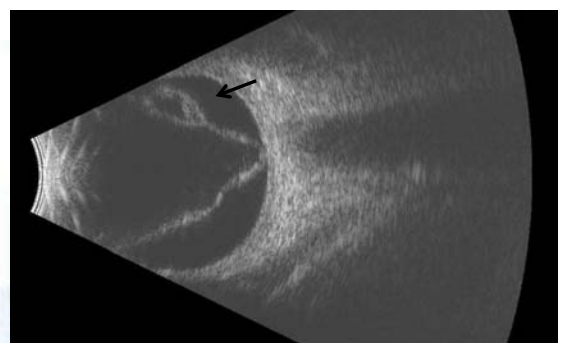
Choroidal + Total RD



Choroidal Detachments

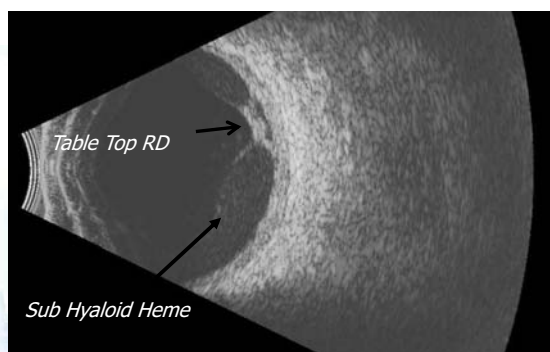


B-scan Echo Patterns



Retinal Detachment with Macro Cyst

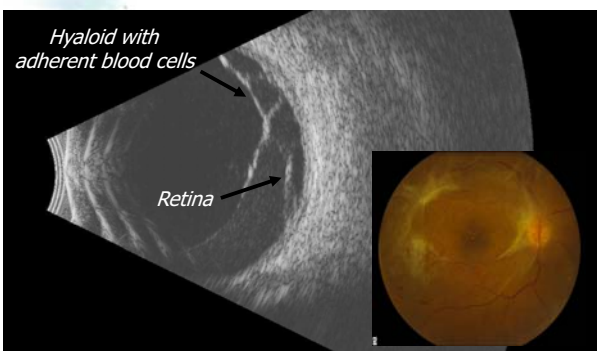
B-scan Echo Patterns



Diabetic Traction Retinal Detachment

Diabetic Traction RD

1EP (Transverse of 1:00 Posterior to Equator)



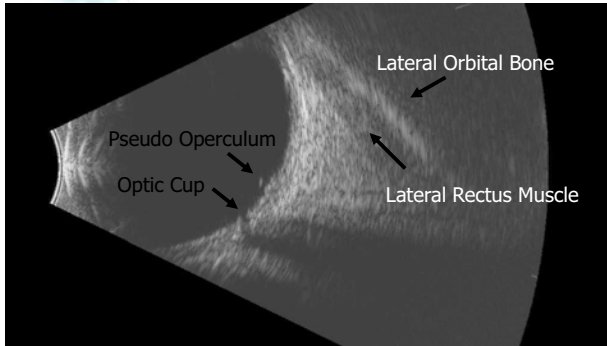
Macula

- **Edema**
- **Holes**
- **Detachment**
- **Tumor**

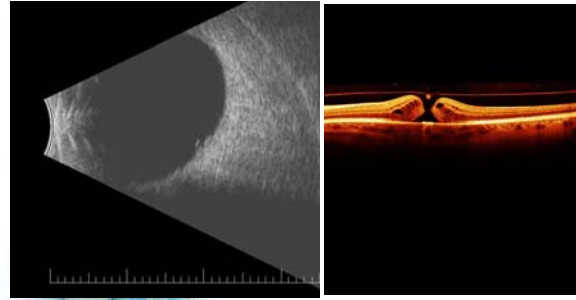


Longitudinal Scans of Macula

Macular Hole with Pseudo Operculum

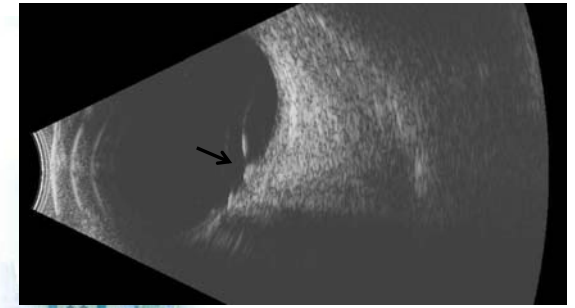


B-scan Echo Patterns



Macular Hole with Pseudo-Operculum

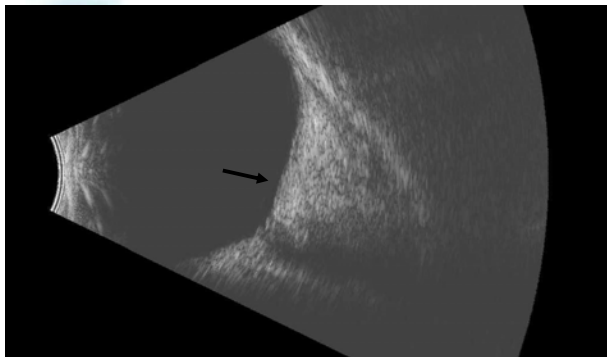
B-scan Echo Patterns



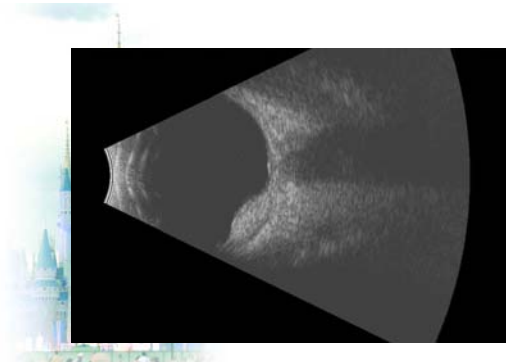
Macular Edema Caused By Vitreomacular Traction

Longitudinal Scans of Macula

Macular Edema without Traction

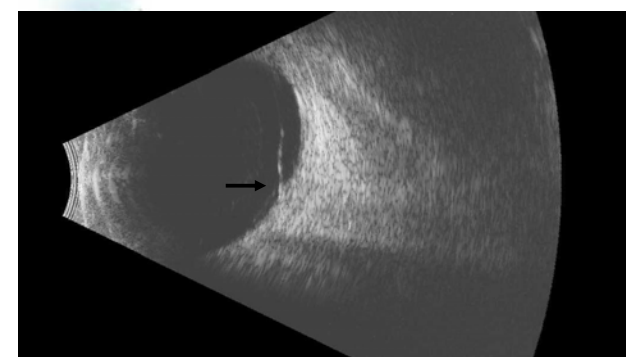


Macular Tumor



Diabetic Traction

L3MAC (Longitudinal of 3:00 OS Macula)



Optic Nerve

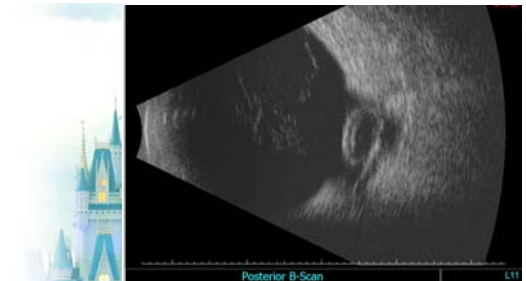
- **Edema**
- **Drusen**
- **Fluid**
- **Colobomas**

Optic Nerve



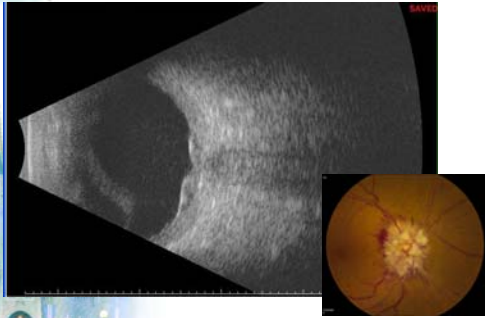
Coloboma

Optic Nerve

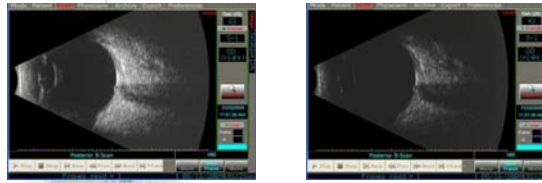


Coloboma

Optic Nerve



Optic Nerve

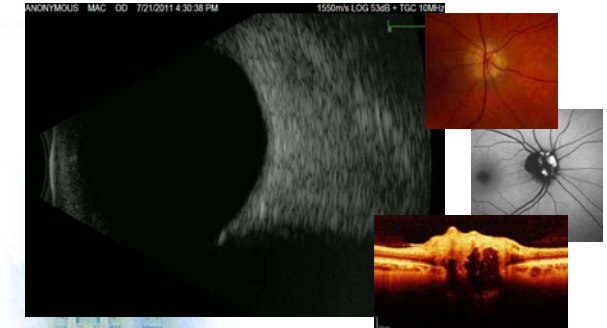


Drusen

High Gain

Low Gain

Optic Nerve



Optic Nerve Drusen

Optic Nerve



Optic Nerve Cupping

Optic Nerve

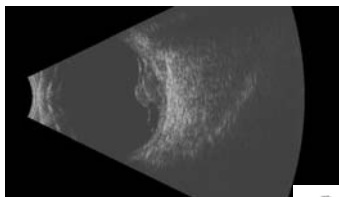


Optic Nerve Avulsion

Tumors

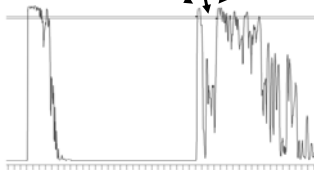
- **Choroidal**
- **Collar button**
 - Extrascleral extension
- **Ciliary body**
- **Orbital**

Tumor Evaluation (1 of 4)



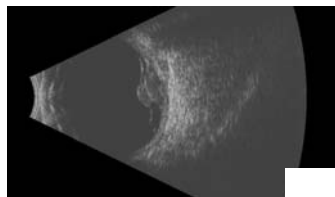
Diagnostic B-scan for location, lateral extent, extra-scleral extension

Internal Tumor Echoes
Tumor Surface
Sclera



Diagnostic A-scan for differentiation, height measurements, extra-scleral extension

Tumor Evaluation (2 of 4)

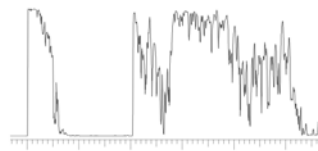


Lower gain on B-scan for better definition

Tissue Sensitivity for this instrument = 67 dB

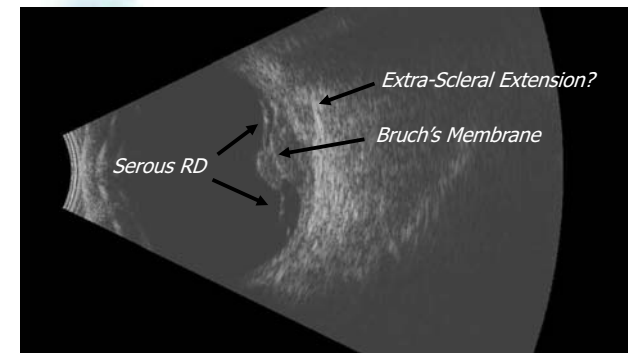
TS = 67dB

Diagnostic A-scan is ALWAYS performed using the correct Tissue Sensitivity

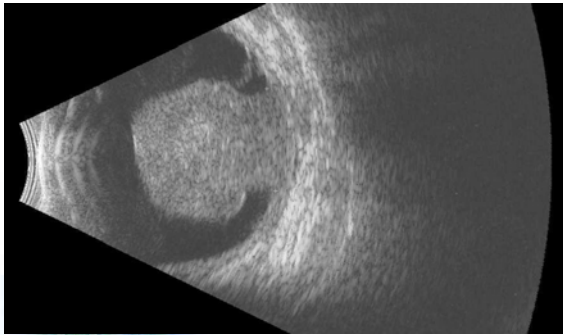


Tumor Evaluation (3 of 4)

Choroidal Melanoma



B-scan Echo Patterns



Malignant Choroidal Melanoma

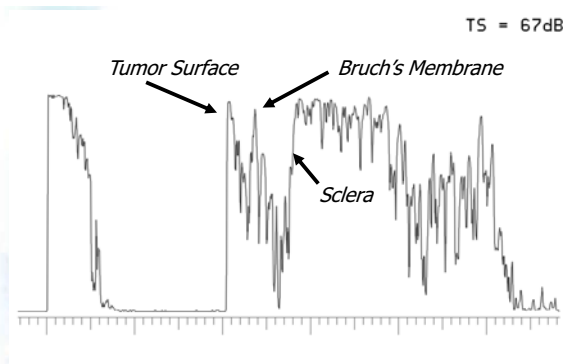
B-scan Echo Patterns



Diagnostic A-scan

- **Tissue sensitivity**
 - Probe to tissue model
- **Internal reflectivity**
 - High
 - Medium
 - Low

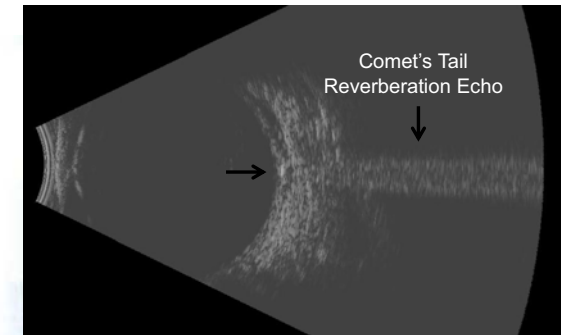
Tumor Evaluation (4 of 4) Choroidal Melanoma



Foreign Bodies

- **Intraocular**
 - Metallic
 - Glass
 - Plastic
 - Intraocular lenses
 - Organic matter
- **Orbital**
 - Buckle
 - Plaque

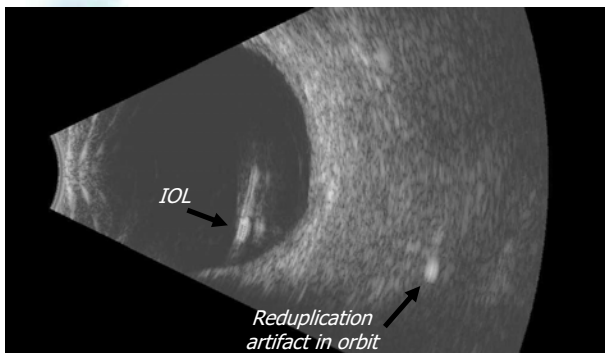
B-scan Echo Patterns



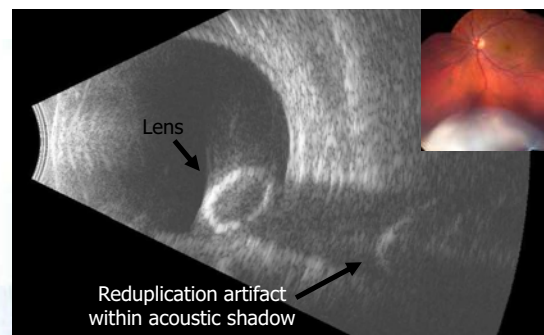
BB Imbedded in Sclera

Dislocated IOL

6PE (Horizontal Transverse of 6:00 Posterior to Equator)



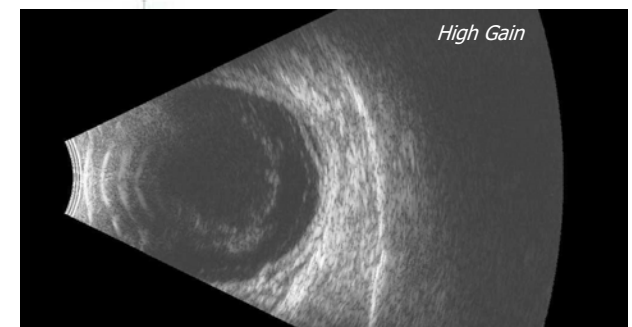
B-scan Echo Patterns



Dislocated Crystalline Lens

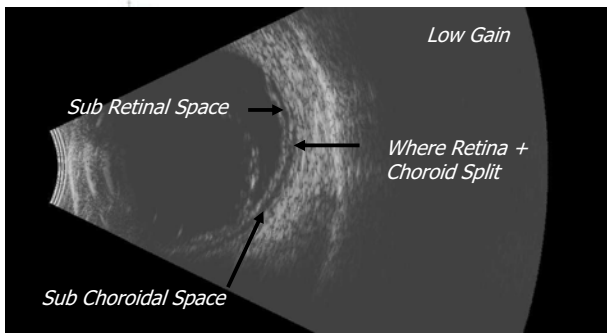
Post Dropped Nucleus (1 of 3)

9EA (Vertical Transverse of 9:00 Anterior to Equator)



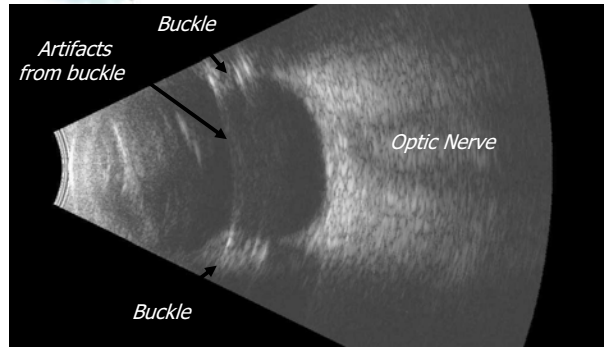
Post Dropped Nucleus (2 of 3)

9EA (Vertical Transverse of 9:00 Anterior to Equator)



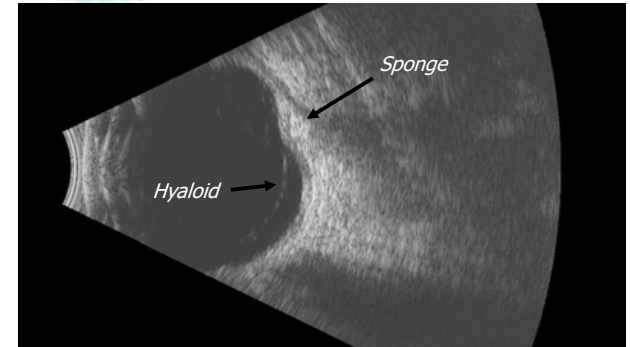
Scleral Buckle

VAX (Vertical Transverse Axial)



Scleral Sponge

L9 (Longitudinal of 9:00)

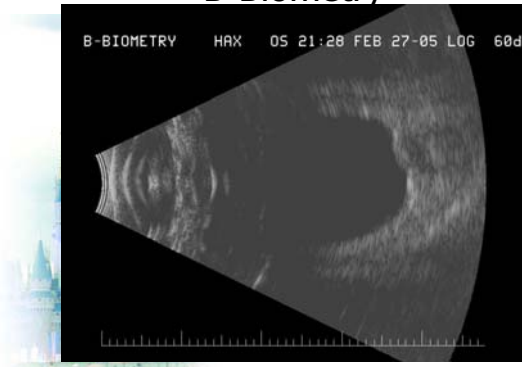


B-Biometry

- Used when confirming A-scan biometry measurements
 - Difficult to measure eyes due to:
 - Staphyloma
 - Silicone oil



B-Biometry



B-Biometry



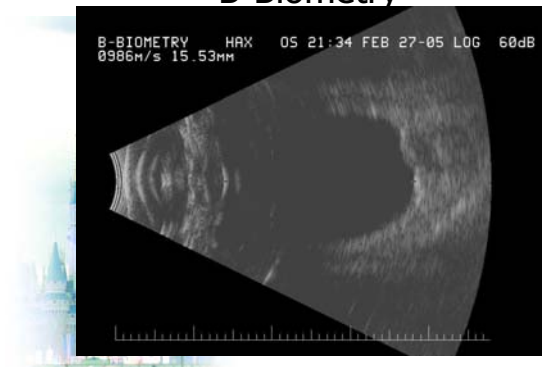
B-Biometry



B-Biometry



B-Biometry



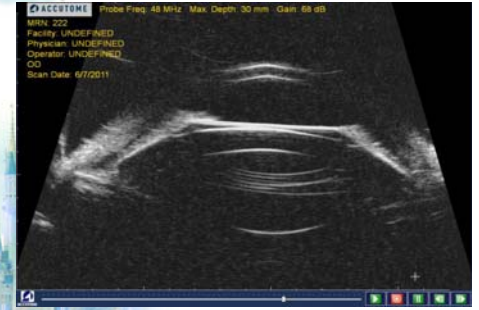
Subluxed IOL



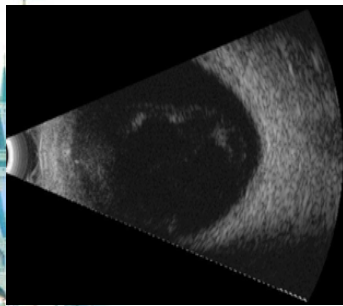
Hyphema, IOL



ICL



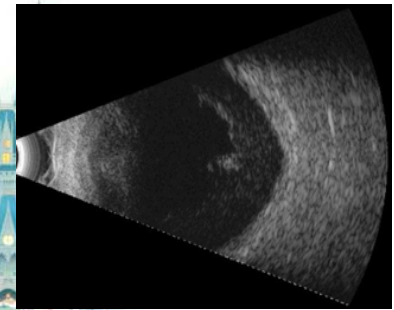
Vitreous Hemorrhage



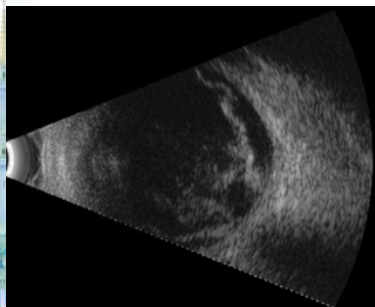
Vitreous Tracks



Subhyloid Hemorrhage



VH RD



Total Retinal Detachment



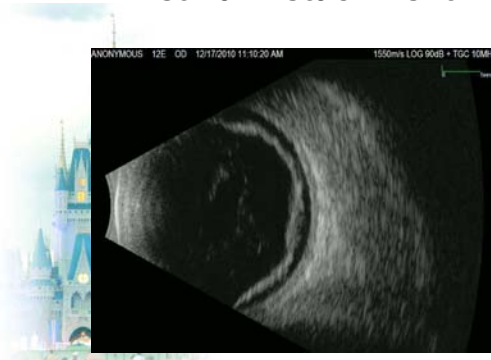
Retinal Detachment Axial



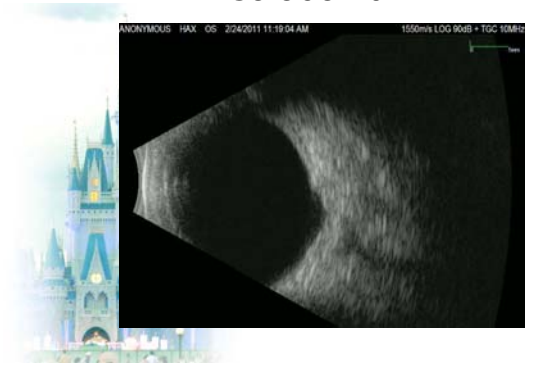
Retinal Detachment
Transverse



Retinal Detachment



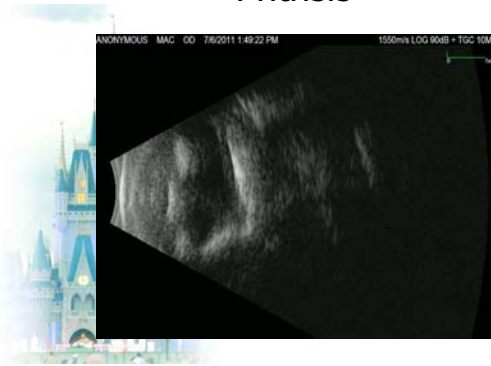
Coloboma



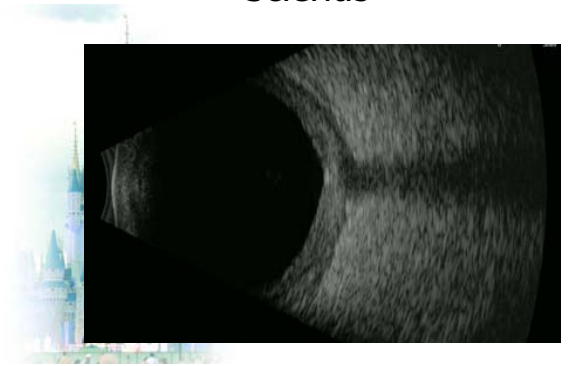
PHPV



Phthisis



Scleritis



Thank You
Enjoy The Meeting