VELAMMAL MEDICAL COLLEGE
HOSPITAL AND RESEARCH INSTITUTE
MADURAI - 625009

1.2.2

Add-on Certificates Details with Report

Index

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Velammal Medical College Hospital
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"Velammal Village"
Madurai-Tuticorin Ring Road
Anuppanadi, Madurai-625 009, T.N.

Department of Physiology

Velammal Medical College Hospital and Research Institute

Madurai

VMCH/Physio/CC/2019/03

CIRCULAR

To First MBBS students of 2019-20 batch

1.11.2019

There will be a certificate course on **Meditation – process and effects** for first MBBS students from 9am to 4pm on Friday, 8-11-2019. All the students are expected to attend the course without fail.

Date: Friday, 8th November 2019

Time: 9am to 4pm

Venue: Lecture Hall 1
First floor
Velammal Medical College

Dr.S.Anu

Professor and Head

Department of Physiology

Departments of Physiology
Velammal Medical College Hospital and RI
Madurai

invite you for

Certificate course in

MEDITATION
- PROCESS AND EFFECTS

PATRON

Shri.M.V.Muthuramalingam, Chairman, Velammal Educational Trust

ADVISORS

Dr.R.M.Raja Muthaiah
Dean

Dr.P.K.Mohanty
Vice Principal

Organising Secretary
Dr.S.Anu, Professor and Head,
Department of Physiology

8 November 2019 • 9:00 am onwards

For First MBBS Students of 2019-20 batch

Venue

Lecture Hall 1, Velammal Medical College

Course Objective

At the conclusion of this activity, the learner (first MBBS student) will be better able to:

- Identifying the physiological basis of meditation
- Understand the health consciousness role of meditation
- Health benefits of meditation and mindfulness

AGENDA

9.00 am	Introduction to meditation
	By Dr.S.Anu, Professor and Head, Physiology
10 am	Physiological basis
	By Dr.M.Shanthi, Professor
11.00 am	Break
11.15 am	Neural and Neurophysiological correlates
	By Dr.K.Rekha, Associate Professor
1 pm	Lunch break
2 pm	Neurophysiological basis of mindfulness
	By Dr.Keba, Assistant Professor
3 pm	Health benefits and meditation
	By Dr.M.Saravanan, Associate Professor
3.45 pm	Vote of thanks
	By Dr.John Rajpathy, Professor
4 pm	Conclusion

Meditation – Process and effects

Mindfulness in Medicine

What is mindfulness

- The health benefits and science behind mindfulness
- How to learn/practice mindfulness

What Is Mindfulness?

Being Present

Definition of Mindfulness

"Paying attention on purpose"

Without judgement

Physiological Effects of Mindfulness

- Changes the structure of the brain
- Affects gene expression (turns genes on and off)
- Improves immune response
- Decreases inflammation
- Can reduce perception of pain
- Reduces cardiovascular risk

Effects of Mindfulness on Brain Structure

Amygdala

Pre-Frontal Cortex

- Decision making
- Problem solving
- Social behavior and reasoning
- Planning
- Initiation of deliberate actions

Effects of Mindfulness on Brain Structure

- 8 week mindfulness course resulted in:

- Decreased size of amygdala
- Increased size of pre-frontal cortex

Study on the Effects of Mindfulness on Inflammation

Healthy Living Class

Mindfulness Course

Public Speaking Task

Mindfulness Effects on Inflammation

- Mindfulness course participants had few inflammatory cytokines than healthy living course participants

Effects of Mindfulness on our Genetics

Effects of Mindfulness on Gene Expression

- Study looking at how genes can be turned on/off through mindfulness practices
- Baseline blood tests for gene expression

8 hrs mindfulness 8 hours relaxation

- Genes that signal inflammation were turned off in the mindfulness group
- Less Inflammation

Effects of Mindfulness on the Immune System

- Mindfulness has been shown to strengthen the immune system.
- Patients who had participated in 8 week mindfulness course reported fewer colds/flus and illnesses of shorter duration

Effects of Mindfulness on Immune Response

- After 8 week mindfulness course participants given flu vaccine were found to have increased antibody titers to the flu virus

Effects of Mindfulness on Perception of Pain

- Study group - four, 20 minute mindfulness classes
- Control group #1– four, 20 minute relaxation classes

Participants subjected to painful experience

In the mindfulness group they found...

- 40% reduction of pain intensity
- 57% reduction in unpleasantness of pain
- "Meditation produced a greater reduction in pain than even morphine or other pain-relieving drugs, which typically reduce pain ratings by about 25 percent."

Effects of Mindfulness on the Cardiovascular System

- Decreased blood pressure
- Decreased insulin resistance
- Decreased cholesterol
- Decreased sympathetic nervous system activation
- Decreases cardiovascular risk

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Department of Physiology
Velammal Medical College Hospital and Research Institute
Madurai
Report

Topic: **Certificate course in Meditation – Process and Effect**

Date: **8-11-2019**

Venue: **Lecture Hall 1, Velammal Medical College**

Target Audience: **First MBBS students 2019-20 batch**

Number of participants: **142**

Report:

A certificate course on Meditation – Process and Effect was organised by Department of Physiology to first MBBS students on 8.11.2019. 142 first MBBS students participated in the course. The program began by 9am with introduction to the topic followed by scientific lectures on Physiological basis, Neural and Neurophysiological correlates, Neurophysiological basis of mindfulness, Health benefits and meditation by faculty of Department of Physiology. The program concluded with vote of thanks.

Outcome:

Students learnt about the concepts of physiological basis of meditation, Understand the health consciousness role of meditation, Health benefits of meditation and mindfulness.

Photos:

Department of Physiology

Velammal Medical College Hospital and Research Institute

Madurai

VMCH/Physio/CC/2020/01

CIRCULAR

To First MBBS students of 2019-20 batch

6.3.2020

There will be a certificate course on **Receptors in Health and Disease** for first MBBS students from 9am to 4pm on Friday, 13-3-2020. All the students are expected to attend the course without fail.

Date: Friday, 13th March 2020

Time: 9am to 4pm

Venue: Lecture Hall 1
First floor
Velammal Medical College

Dr.S.Anu

Professor and Head

Department of Physiology

Departments of Physiology
Velammal Medical College Hospital and RI
Madurai

invite you for

Certificate course in

RECEPTORS
IN HEALTH AND DISEASE

PATRON

Shri.M.V.Muthuramalingam, Chairman, Velammal Educational Trust

ADVISORS

Dr.R.M.Raja Muthaiah
Dean

Dr.P.K.Mohanty
Vice Principal

Organising Secretary
Dr.S.Anu, Professor and Head,
Department of Physiology

13 March 2020 • 9:00 am onwards

For First MBBS Students of 2019-20 batch

Venue

Lecture Hall 1, Velammal Medical College

Course Objective

At the conclusion of this activity, the learner (first MBBS student) will be better able to:

- Know the basics of endocrine system function
- Classify the endocrine receptors
- Discuss the various mechanism of action of hormones based in receptors
- List the importance of receptors in health and disease

AGENDA

9.00 am	Introduction to Endocrine system
	By Dr.S.Anu, Professor and Head, Physiology
10 am	Physiological basis of endocrine action
	By Dr.M.Saravanan, Associate Professor
11.00 am	Break
11.15 am	Receptors and its nature
	By Dr.Keba, Assistant Professor
1 pm	Lunch break
2 pm	Endocrine mediation via receptor action
	By Dr.M.Shanthi, Professor
3 pm	Receptors - applied
	By Dr.K.Rekha, Associate Professor
3.45 pm	Vote of thanks
	By Dr.John Rajpathy, Professor
4 pm	Conclusion

Hormone receptors

modified proteins having specific binding sites for a hormone

Target cells: cells with specific binding sites for that hormone

Same cell can have receptors for various hormones

Magnitude of hormone activity depends on

- number of receptors
- affinity for a hormone

When a hormone combines with its receptor, a cascade of reactions are activated : amplification at each level

Location of receptors

- External receptors
  - Cell membrane
    - Protein, peptide hormones, catecholamines
- Internal receptors
  - Cytoplasm
    - steroid hormones
  - Nucleus
    - thyroid hormones

Down-regulation of receptors

decrease in the number of receptors due to increase in the concentration of the hormone

causes a decrease in the response of target tissue

due to inactivation of receptors and decreased production of receptors

Up-regulation of receptors

decrease in the concentration of hormone triggers the formation of more receptors

causes the target tissue to become more sensitive to the stimulating effects of hormone

Hormone transport

Transported either in free form or bound to plasma

Proteins and catecholamines are soluble in plasma and transported in free form

Steroid binding proteins

bound forms are biologically inactive

serve as a reservoir for hormones

Protects the hormone against clearance by the kidney

Slows down the rate of degradation by the liver

Mechanism of action of hormones

Hormone – Receptor complex ⇨ alters the structure and function of the receptor

altered receptor produces the desired response by

- change in the membrane permeability of the cell
- G protein activation
- activation of an intracellular enzyme (second messengers)
- through tyrosine kinase activation
- activation of genes

- change in the membrane permeability

Eg. Epinephrine and norepinephrine from adrenal medulla

Hormones bind to receptors on the postsynaptic membrane
Cause a structural change in the receptor causing opening or closing of ion channels
Alteration of movements of ions across the channels brings about a change in the membrane permeability of the postsynaptic cell

- G protein activation

G proteins are a group of cell membrane proteins which are coupled with hormone receptors and regulate the activity of target cells
Convert signals to biological activities
stimulatory G-protein (G_s) and and inhibitory G-protein (G_i)
When an activating signal reaches G protein, GDP is exchanged for GTP
GTP-protein complex influence signal transductions → generation of intracellular signals → physiological effects of the hormone
After the action of the hormone, G protein will convert GTP back to GDP → G protein in resting state

- G protein activation
- G proteins
- small G proteins
  responsible for many cellular functions
  six different families of small G proteins (Rab, Ras, Rac)
- Heterotrimeric G proteins
  made up of α, β and γ subunits
  five different families
  directly open ion channels or catalyze second messengers
- Activation of intracellular enzyme
- Binding of hormone to its receptor activates an enzyme inside the cell membrane
- Second messenger comes into play for mediating the effect inside the cell
  Cyclic AMP
  Cyclic GMP
  Ca^{++}
  Calmodulin
  Membrane phospholipid
- Cyclic AMP system
- Cyclic adenosine monophosphate
- Produced from ATP by adenyl cyclase
- Hormones + Receptors → G-protein-stimulating adenyl cyclase coupling → ATP ⇨ cAMP
- cAMP activates cAMP-dependent protein kinase → phosphorylation of specific proteins in the cell → physiological effects
- Eg. ACTH, LH, TSH
- Cyclic AMP system
- Membrane phospholipid
- Hormones + Receptors → Activation of phospholipase C enzymes
- Breakdown of phospholipids such as phosphatidylinositol biphosphate (PIP_2) of cell membrane → inositol triphosphate (IP_3) and diacylglycerol (DAG)
- IP_3 activates calcium and causes second messenger effects

- DAG activates enzyme protein kinase C → phosphorylates proteins
- Membrane phospholipid
- Calcium calmodulin system
- Operates in response to entry of calcium ions into the cell
- Opening of calcium channels caused by a change in the membrane potential or action of hormone
- Inside the cell calcium binds to Calmodulin
- Change in shape of calmodulin initiates multiple effects inside the cell
- Calcium calmodulin system
- Activation via tyrosine kinase
- Hormone receptors possessing intrinsic tyrosine activity

  Eg. Insulin, epidermal growth factor

  Hormone + Receptor → receptor autophosphorylation → phosphorylates tyrosine residue → enzyme activation and gene transcription
- Hormone receptors that do not possess intrinsic tyrosine activity

  Eg. growth hormone, prolactin-releasing hormones, cytokines

  Hormone + Receptor → attract and dock the intracytoplasmic tyrosine kinases [such as Janus tyrosine kinases (JAK) and signal transducer and activator of transcription (STAT) kinases] → activated intracytoplasmic tyrosine kinases phosphorylate transcription factor proteins → modulate gene expression
- Activation via tyrosine kinase
- Activation of genes
- Eg. Steroid hormones, retinoids and thyroid hormones
- Hormone + binding proteins → target cells → diffuse to interior of the cell
- Hormone + Receptor complex → activation → into nucleus → binds to protein of DNA
- Transcription of mRNA → translation → formation of new protein
- Activation of genes
- Hormonal assay

Measurement of hormone concentration in the blood

- Bioassay

observing quantitatively the specific biological effect in animals

- Radioimmunoassay (RIA)

based on competitive binding of hormone and radio-labelled hormone to a specific antibody

- Enzyme linked immunosorbent assay (ELISA)

based on antigen-antibody reaction

- Cytochemical assay

genesis of hormone detected in the gland

- Dynamic tests

Suppression type of dynamic tests

Stimulation type of dynamic tests

Department of Physiology
Velammal Medical College Hospital and Research Institute
Madurai
Report

Topic: **Certificate course in Receptors in Health and Disease**

Date: **13-3-2020**

Venue: **Lecture Hall 1, Velammal Medical College**

Target Audience: **First MBBS students 2019-20 batch**

Number of participants: **142**

Report:

A certificate course on Receptors in Health and Disease was organised by Department of Physiology to first MBBS students on 13.3.2020. 142 first MBBS students participated in the course. The program began by 9am with introduction to the topic followed by scientific lectures on Physiological basis, Receptor and its nature, Endocrine mediation via receptor action and applied aspects of Receptors by faculty of Department of Physiology. The program concluded with vote of thanks.

Outcome:

Students learnt about the concepts of physiological basis, classification of receptors and its importance in signal mediation, health and disease related applied aspects.

Photos:

Velammal Medical College Hospital and Research Institute

Ref. No: VMCHRI/BIOCHEM/CC-5 Date: 03.02.2020

CIRCULAR

To

All Doctors

Certificate Course on ELISA Technique

Department of Biochemistry is organizing a certificate course on ELISA Technique on 26.02.2020 (Wednesday) between at 9.00 AM to 3.00 PM.

All Faculties are invited.

VICE PRINCIPAL

Dr. P.K. MOHANTY
Vice Principal
Velammal Medical College Hospital
and Research Institute
Madurai-625 009

Copy submitted to:

The Hon. Chairman

Copy to:

The Dean

Medical Superintendent

Chief Administration Officer

HOD, Biochemistry

All Clinical and Non-Clinical HODs

Velammal Medical College Hospital & Research Institute

Anuppanadi, Madurai - 625009

Department of Biochemistry

Certificate course on

ELISA Technique

Venue: Biochemistry Demonstration Room

Date: 26.02.2020

Time: 9.00 AM – 3.00 PM

For First year M.B.B.S., students

PATRON

Chairman: Shri.M.V.Muthuramalingam

Advisors:

Dean: Dr.T.Thirunavukarasu

MS: Dr. S.R.Damodaran

DR.K.Suganthy
Course coordinator
Biochemistry

DR.P.K.Mohanty
Vice Principal
Prof. HOD Biochemistry

Objective: The participant should be able to perform ELISA

Teaching Method: Lecture and demonstration

Agenda

Time	Topic	Speaker
9.00 9.15 AM	Welcome address	DR.P.K.Mohanty
9.15 – 9.45 AM	Pre test	Dr.K.Suganthy
9.45 – 11.00 AM	ELISA – Principle and types	Dr.K.Suganthy
11.00 – 1.00 PM	Demonstration: ELISA – ANA estimation	Dr.K.Suganthy & Resource persons
1.00 – 2.00 PM	LUNCH	
2.00 – 2.30 PM	Post-test	Dr.K.Suganthy
2.30 – 3.00 PM	Feed back and Valediction	DR.P.K.Mohanty

Resource persons

Dr P.K. Mohanty
Vice Principal
Prof. HOD
Biochemistry

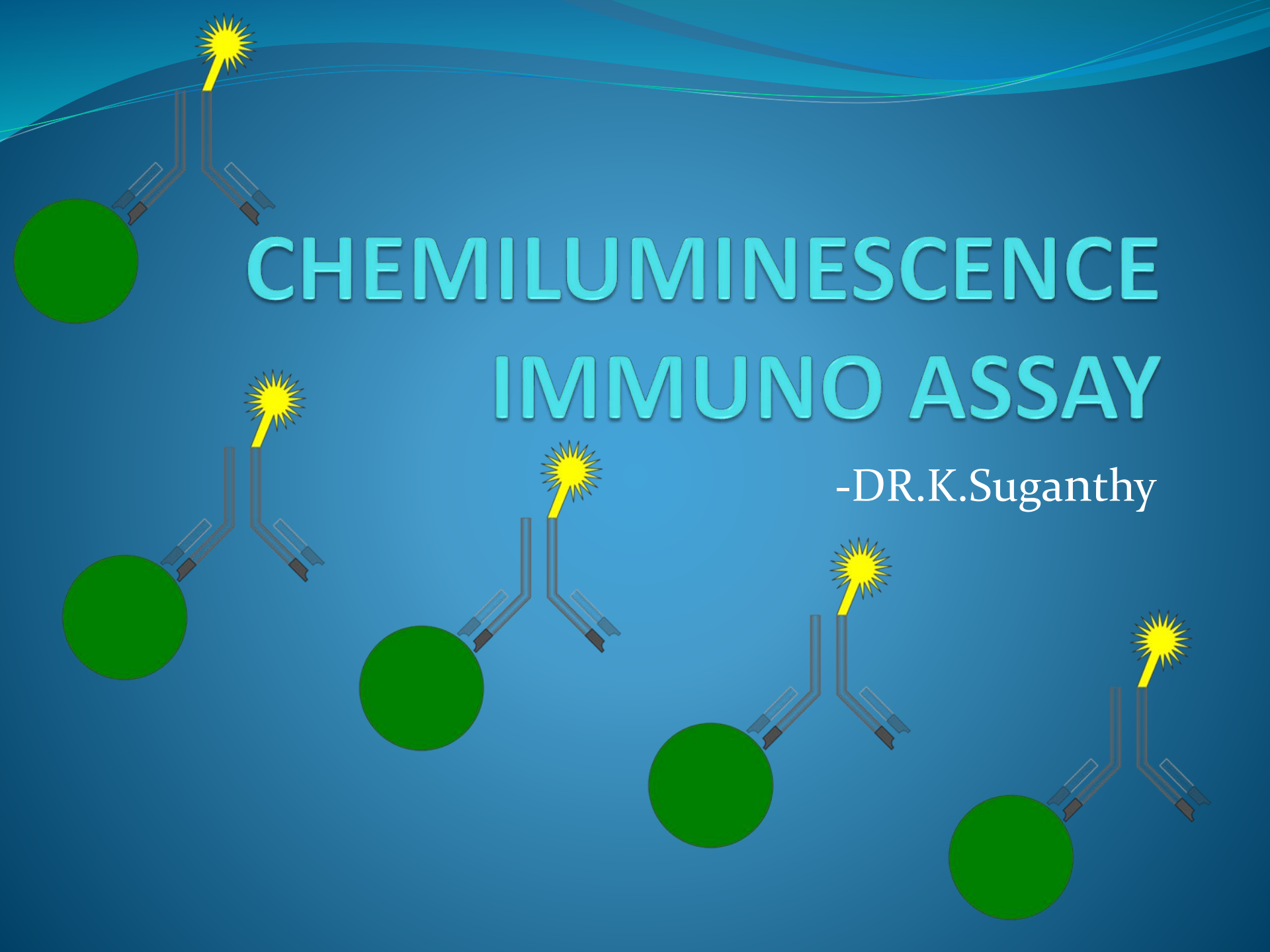
Dr K. Suganthy
Prof.
Biochemistry

DR.M.Jeyakumar
Assoc. Professor
Biochemistry

Dr Mamatha T Shenoy
Assistant Professor
Biochemistry

Dr.A. Hariharan
Assistant Professor
Biochemistry

Dr.M. Viveka
Tutor
Biochemistry


CHEMILUMINESCENCE
IMMUNO ASSAY
-DR.K.Suganthy

Introduction

- Definition of an immunoassay:
- An immunoassay is an analytical technique which uses naturally occurring reagents known as antibodies for the selective determination of sample components
- Immunoassays are commonly used in a wide variety of areas, especially in biochemistry and clinical chemistry

Application of immunoassay include:

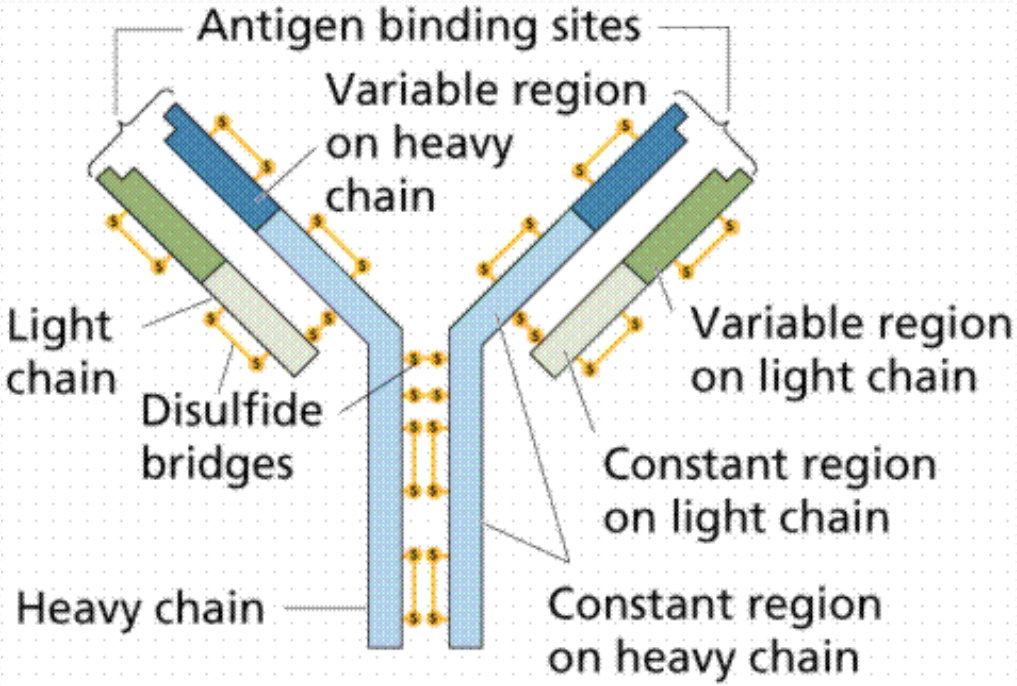
- Drug testing
- Hormone testing (insulin in diabetic patients)
- Bacterial or viral testing (AIDS, hepatitis)
- Environmental testing (herbicides, pesticides)

Advantages of immunoassays are:

- Inexpensive to perform
- Highly selective
- Low limits of detection
- Can have high-throughput. Often done in batch mode
- Applicable to the determination of a wide-range of compounds

Antibodies

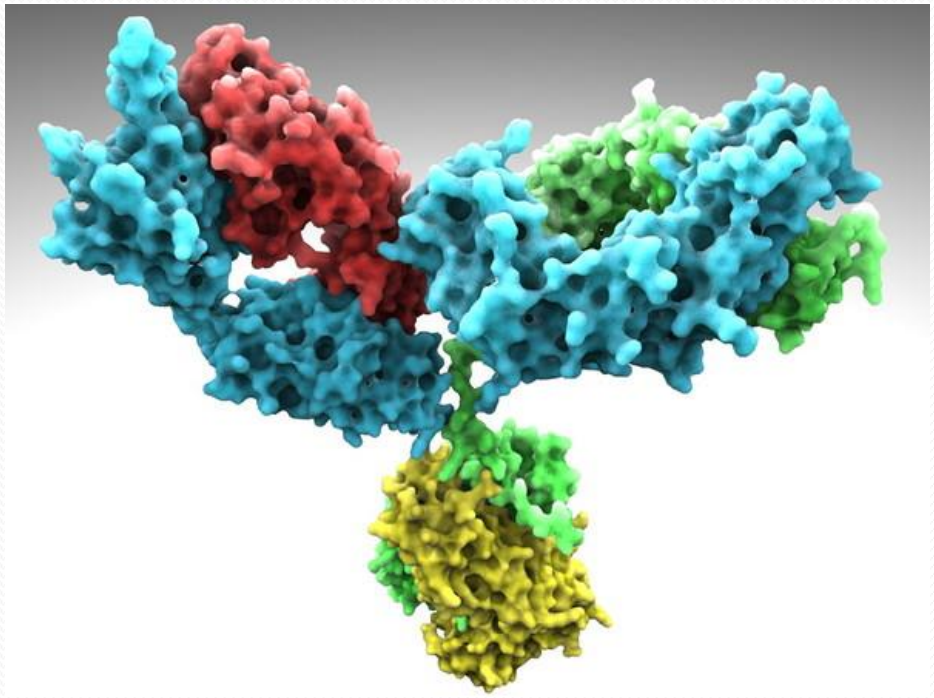
- Definition of an antibody:
- An antibody (Ab), or immunoglobulin (Ig), is a member of a family of glycoproteins that make up part of the body's immune system.
- Basic structure of an antibody:

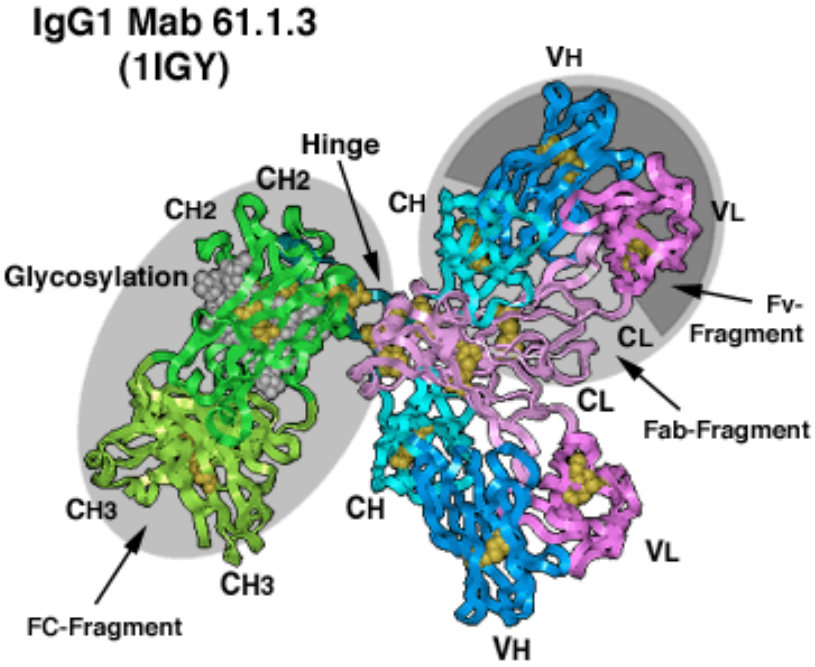


The above antibody consists of four polypeptides-two identical heavy chains (H) and two identical light chains (L) connected by disulfide bonds. These are arranged in a "Y"-shaped structure ending with two identical sites that recognize and bind a given foreign agent or antigen

IMMUNOASSAYS

- Antibodies
- II. Basic structure of an antibody:
- More realistic graphical representations of an antibody or Ig

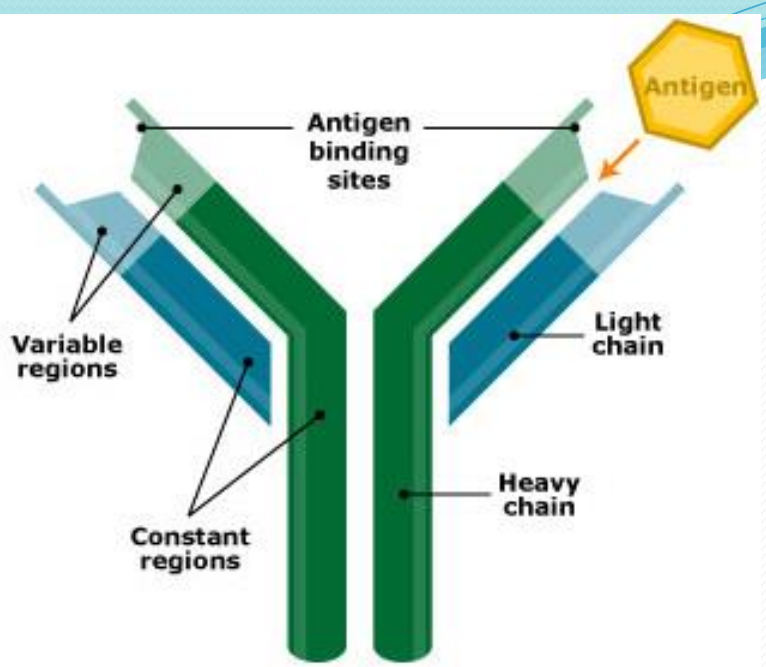




IMMUNOASSAYS

Introduction

IV. Antibody – Antigen Interactions:



- Each antibody has the ability to bind to a different foreign agent, or antigen (Ag)
- The ability of an antibody to recognize and bind a given antigen depends on the structure of its binding site
  - Determined by the amino acid sequence of the antibody near the N-terminal ends of the heavy and light chains

IMMUNOASSAYS

Introduction

IV. Antibody – Antigen Interactions:

- The general reaction between a single binding site on the antibody (Ab) and antigen (Ag) can be written as follows:

$$Ab + Ag \underset{}{\overset{K_a}{\longleftrightarrow}} Ab\text{-}Ag$$

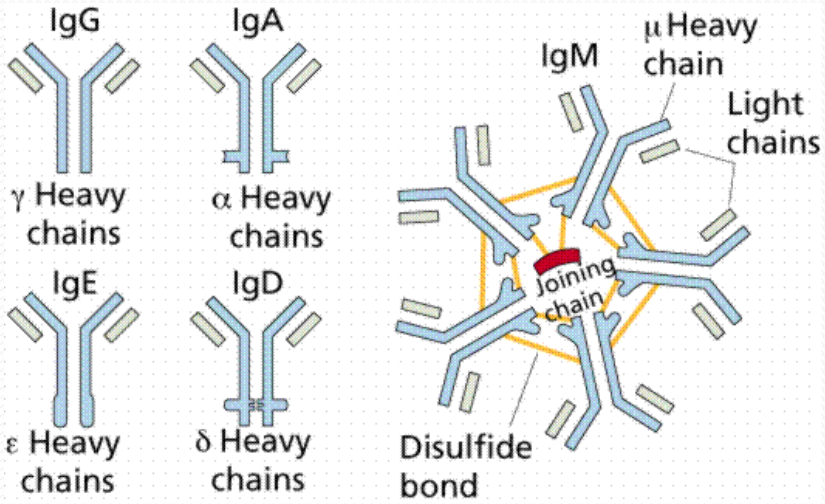
  - where K_a is the binding or association equilibrium constant

- The value of K_a is typically in the range of 10^6 to 10^{10} M^{-1}
- The binding is very selective and only occurs between *Ab* and *Ag*, or between *Ab* and molecules similar to *Ag* in their three-dimensional structure.

IMMUNOASSAYS

- Antibody Usage:
- The selectivity of Ab-Ag interaction makes antibodies useful as analytical reagents for the determination of specific components in mixtures
- Antibodies are useful as analytical reagents since they can be produced to a wide variety of substances:

Five classes of antibodies



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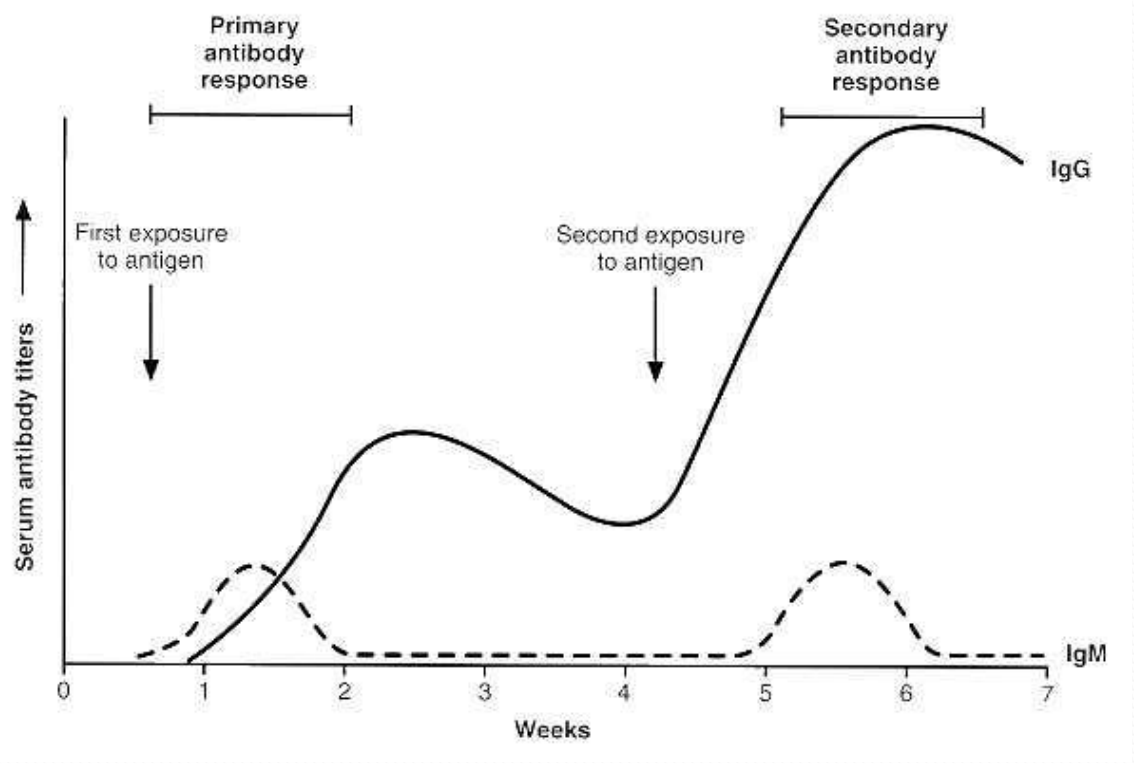
VI. Antibody Production - polyclonal antibodies :

- One common method for making antibodies to a substance (antigen) is to inject the analyte or analyte-protein conjugate into an animal several times over a period of a few weeks to a few months



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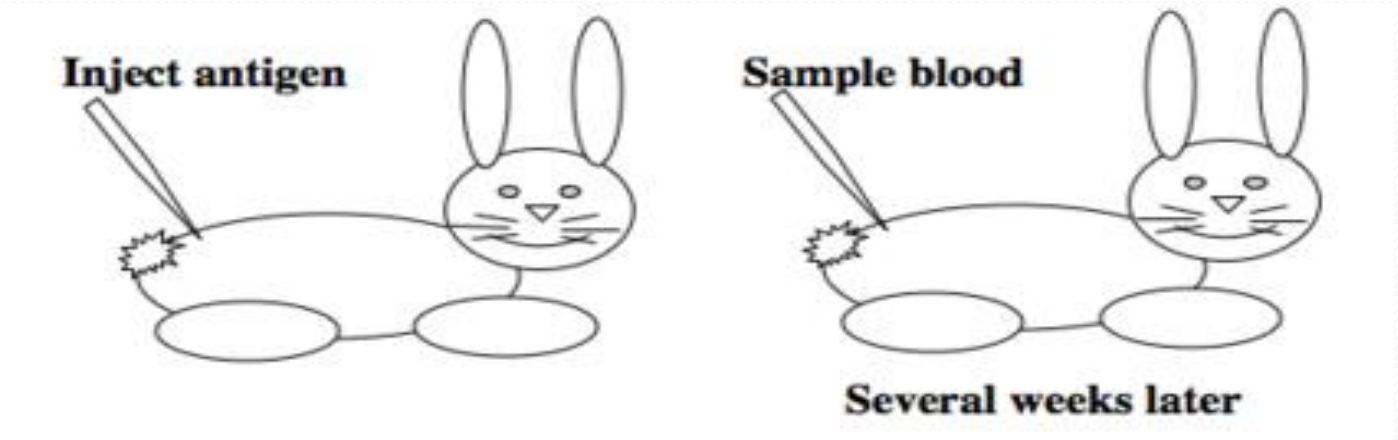
VI. Antibody Production – polyclonal antibodies:

- If the agent is a foreign to the animal, the animal will develop antibodies to the agent and release these antibodies into its blood.
- After a few months, blood is removed from the animal and the antibodies produced are collected for use

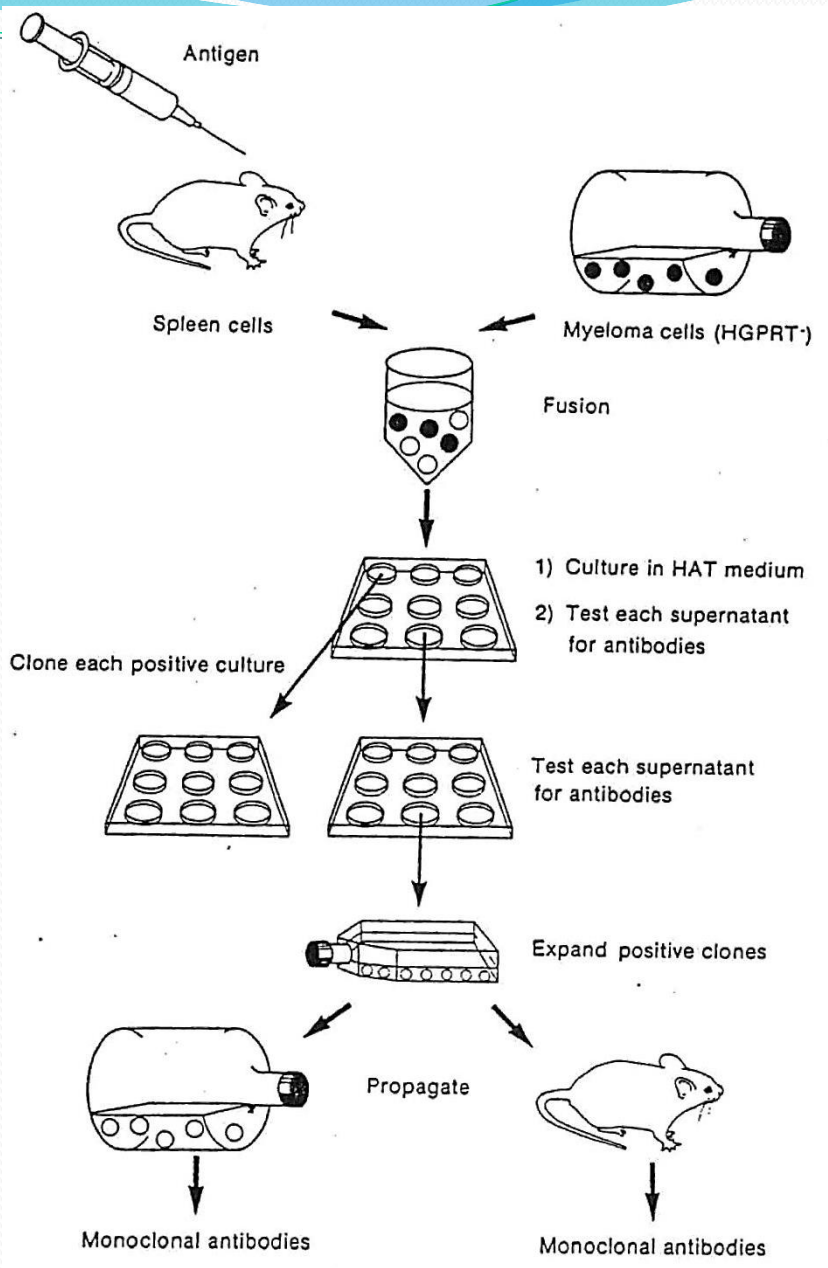


- Antibodies produced in this fashion are typically very heterogeneous
  - Recognize a number of different sites on the analyte
  - Binding with a range of affinities (Ka)
- Heterogeneous antibodies are known as polyclonal antibodies
  - Arise from several different lines of antibody-producing cells within the animal

IMMUNOASSAYS

Antibody Production - monoclonal antibodies (mAb):

- **Monoclonal antibodies differ from polyclonal antibodies in that they are produced by a single cell line within the body**
- **All monoclonal antibodies from the same cell line recognize the same site on an analyte and bind with an identical binding affinity (Ka)**



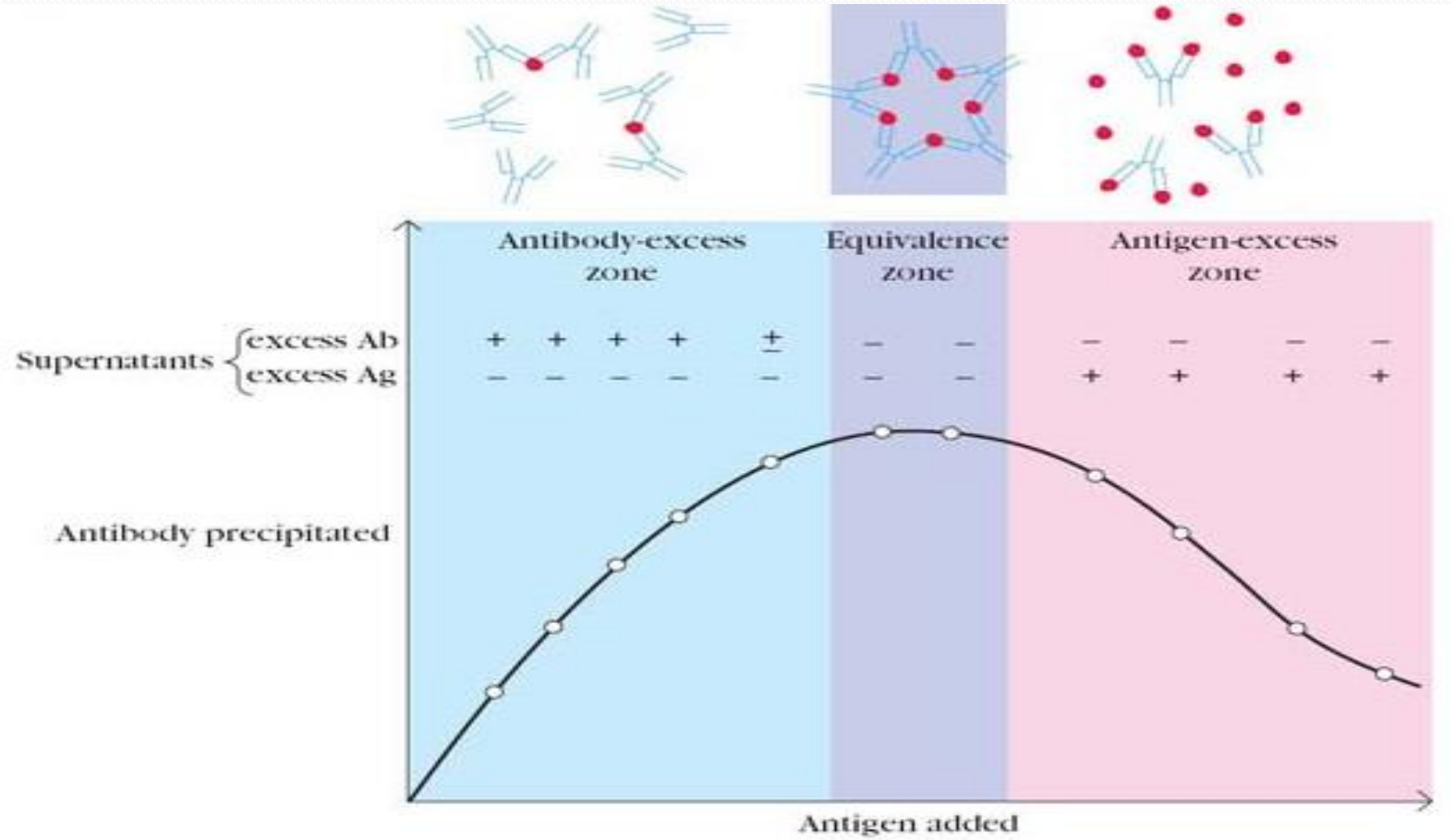
IMMUNOASSAYS

Types of Immunoassays

- **There are several different ways in which antibodies can be used in the detection or analysis of an antigen. Some common ways include:**
- **Precipitation-based immunoassay**
- **Competitive binding immunoassay**
- **Sandwich immunoassay**

IMMUNOASSAYS

Precipitation assays



LUMINESCENCE

- “ Cold light” that can be emitted at **lower temperature**
- Source kicks an electron of an atom out of its lowest energy “ground” state into a higher energy “excited” state
- Finally electron returns the **energy** in the form of **light** so it can fall back to its “ground” state

TYPES LUMINESCENCE

Excitation event		**process**
Chemicals	Luminol Isoluminol acridinium ester	**Chemiluminescence**
Biochemical	Luciferin aequorin	**Bioluminescence**
Electromagnetic	Ruthenium Tris (bipyridly) chelate	**Electroluminescence**
Photons	inorganic phosphors	**Photoluminescence**

CHEMILUMINESCENCE

Emission of light with limited emission of heat (luminescence), as the result of a chemical reaction.

[A] + [B] → [◊] → [*Products*] + *light*

[A], [B]: reactants

[◊]: excited intermediate

For example, if [A] is luminol and [B] is hydrogen peroxide in the presence of a suitable catalyst we have:

luminol + H2O2 →3-APA[◊] →3-APA + light

Where:

- 3-APA is 3-aminophthalate
- 3-APA[◊] **is the excited state** producing **light** as it decays to a lower energy level.

CHEMILUMINISCENCE

Luminol and peroxidase before adding H_2O_2

Chemiluminiscence after addition H_2O_2

Application of Chemiluminiscence

- **Chemiluminesence immunoassay**
- **DNA hybridization detection**
- **Western blotting**
- **Forensic science**
- **Food analysis**

CLIA has become very popular in clinical chemistry and environmental analysis, due to its high sensitivity, wide dynamic range and complete automation.

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MicroSlide™ MicroTip™ MicroSensor™ MicroWell™

integrity by intelli check

VITROS System 3600* Immunodiagnostic

MicroSensor™ MicroWell™

integrity by intelli check

* Under Development

Microwell Technology is based on

Enhanced Chemiluminescence Technology

- High sensitive Labelled Immunoassay
- For the detection of either Antigen or Antibody based on
- Immunometric assay (Sandwich assay)
- Competitive Immunoassay

Immunoassay: Definition

- A measurement technique which uses an antibody (or antigen) in combination with a sensitive detection signal for the quantitive (or qualitative) determination of an antigen (or antibody) in a patients specimen.

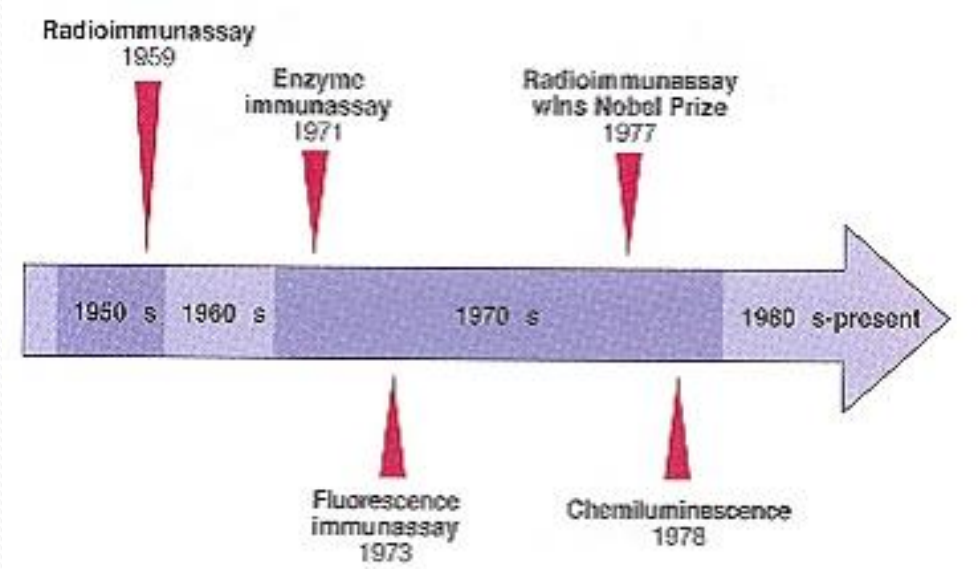
Types of immunoassays

Radioimmunoassay (RIA)

Enzyme immunoassay (ELISA)

Fluorescence immunoassay

Chemiluminescence's immunoassay



Timeline of development of immunoassays

Classic Immunodiagnostics Detection Techniques

- **Radiolabels: RIA**
  - Slow processes
  - Difficult to automate
  - Short shelf life
  - Regulatory scrutiny and disposal hazard

- **Colorimetric: ELISA**
  - Limited sensitivity

- **Fluorescence: FPIA (i.e.: AxSYM, TDx)**
  - Can suffer from background interference
  - Limited sensitivity
  - Limited to small molecules

Chemiluminescence Immunoassay

- Chemiluminescence technology – based on the emission of light (luminescence) as a result of chemical reaction.
- [**A**] + [**B**] → [*Products*] + light
- For example, if [A] is luminol and [B] is hydrogen peroxide in the presence of a suitable catalyst we have:
- Luminol + H_2O_2 → 3-APA[◊] → 3-APA + Light :
- where 3-APA is 3-aminophthalate & 3-APA[◊] is the excited state fluorescing as it decays to a lower energy level.

The Chemiluminescence Advantage

- **Chemiluminescence: Two primary types**
  - **Direct "Flash" (ACS:180, Architect)**
  - **Indirect "Glow" (ECi, Immulite, access)**
- **Enhanced Chemiluminescence**
  - Chosen technology for *Vitros* ECi
  - Horseradish Peroxidase (HRP) is the label
  - Luminol is the substrate: Together with H_2O_2,
  - Enhancer (acetanilide) act as catalysts
  - Enhancers speed the oxidation of the luminol by HRP by as much as 1,000 times.
  - Enhancer enhances the light intensity of each luminol molecule and sustains light production so that resulting light output is transformed from flash to glow

Enhanced Chemiluminescence Immunoassay

Immunodiagnostic

-based on the reaction : antibody - antigen
-sensitivity : up to picomol/L (0.000000000001 mol)
-specificity: based on antibodies recognising the analyte

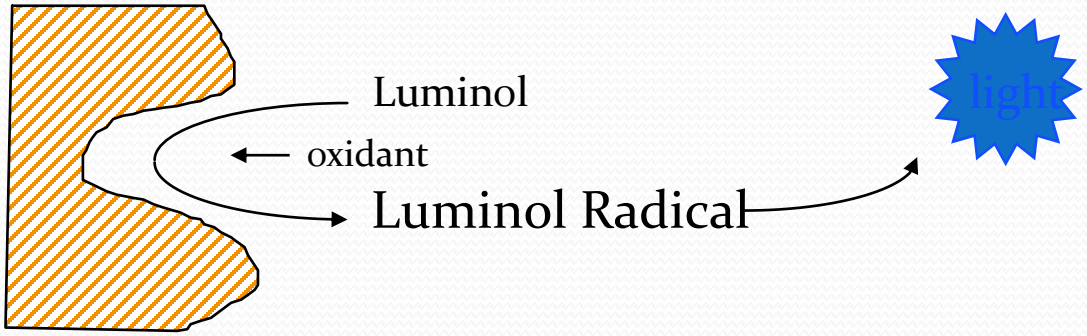
Chemiluminescence

-detection and measurement of the immunological reaction : oxidation of *luminol* and photoemission at 410 nm

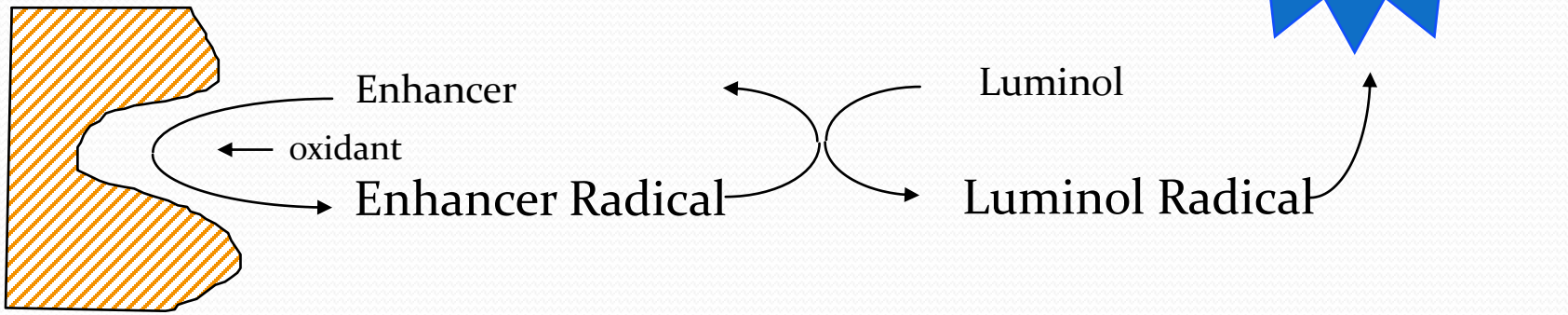
Enhanced

-Photons react with an *enhancer* which amplifies the lasting and the intensity
of the signal. The signal is read by the *luminometer*
-sensitivity : * 1000000 compared to the clinical chemistry
ex: Fe: 0.4 µmol/L - E2: 2.7 pmol/L = 40 000 times
1 gramme of component in 40 Olympic swimming pools !

Unenhanced and Enhanced Luminescence



UNENHANCED



ENHANCED

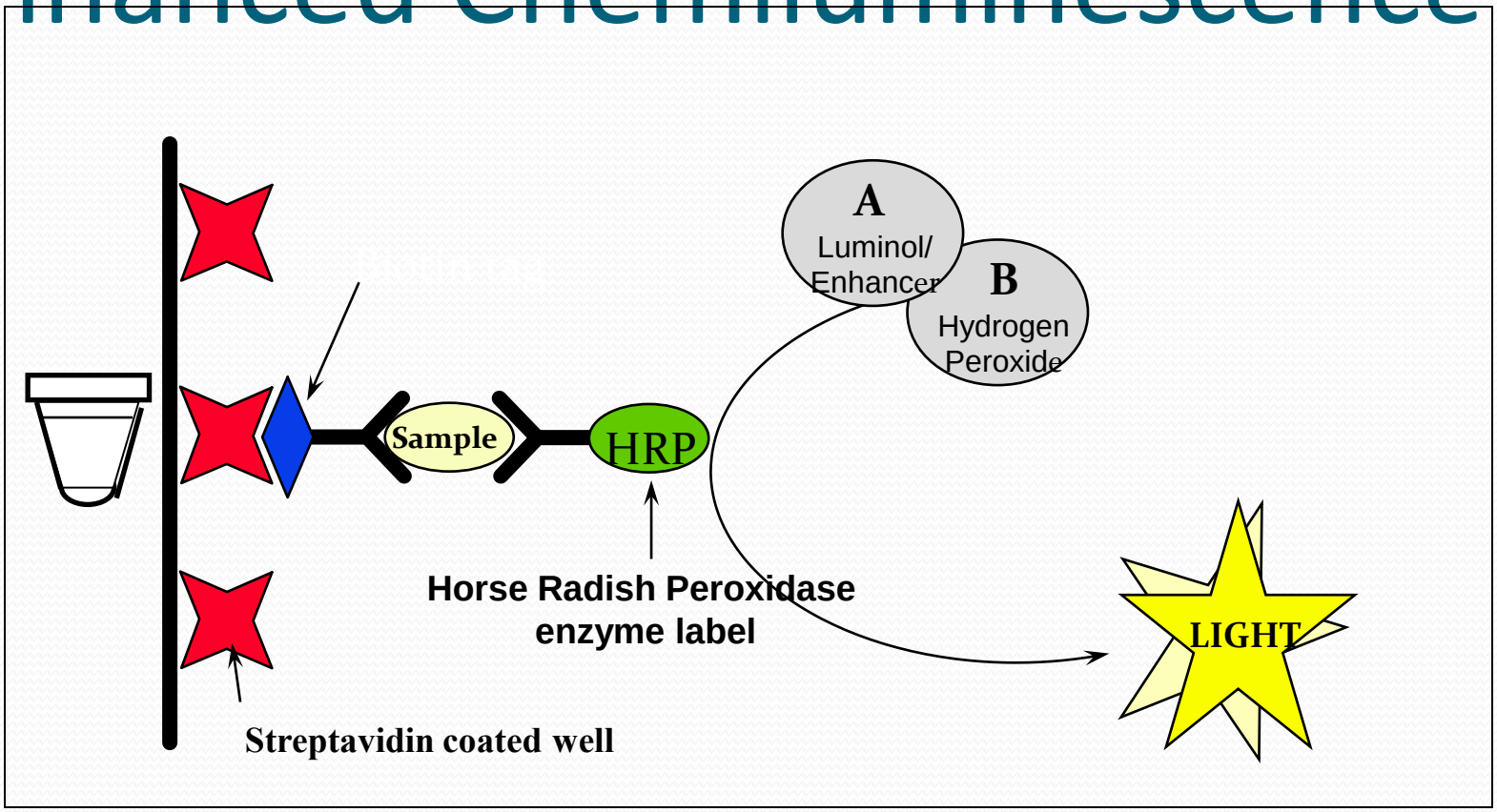
The Basic Principles of ECLIA Technology

- ECLIA
  - *Enhanced Chemiluminescence Immuno Assay*
- The technique utilises the relationship between Antigen (Ag) and the associated Antibody / Antibodies (Ab)
- The presence of Ag or Ab can be Quantified / Qualified by using a detection system using the enzyme Horse Radish Peroxidase.

The Basic Principles of ECLIA Technology

- ECLIA
  - The Enzyme HRPO oxidises Luminol in the presence of Hydrogen Peroxide.
  - The oxidized Luminol produces a glow of light.
  - The light generated is enhanced by the enhancer 4 Chloro 3 Hydroxy Acetanilide.
  - The enhanced light is measured using Luminometer.

Enhanced Chemiluminescence



Signal Generation with Peroxidase

Traditional ELISA

$$\underset{\text{colorless}}{OPD} + H_2O_2 \xrightleftharpoons{POD} \underset{\text{colored}}{Dye_{OX}} + H_2O$$

Chemiluminescence Chemistry

$$Luminol + H_2O_2 \xrightleftharpoons{POD} Dye_{OX} + H_2O + Light$$

Signal Generation with Peroxidase

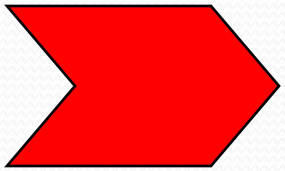
Chemiluminescence Chemistry :

$$H_2O_2 + POD \rightleftharpoons H_2O + O$$

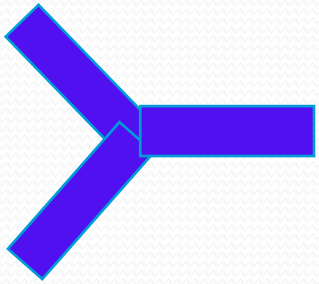
$$\text{Luminol} + O \rightarrow \text{Oxidized Luminol} \rightarrow \text{Light}$$

$$\text{Light} + 4Cl3HA \rightleftharpoons \text{Enhanced Glowing Light}$$

Basic Principle of Chemiluminescence Sandwich Assay



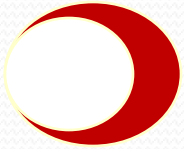
Antigen



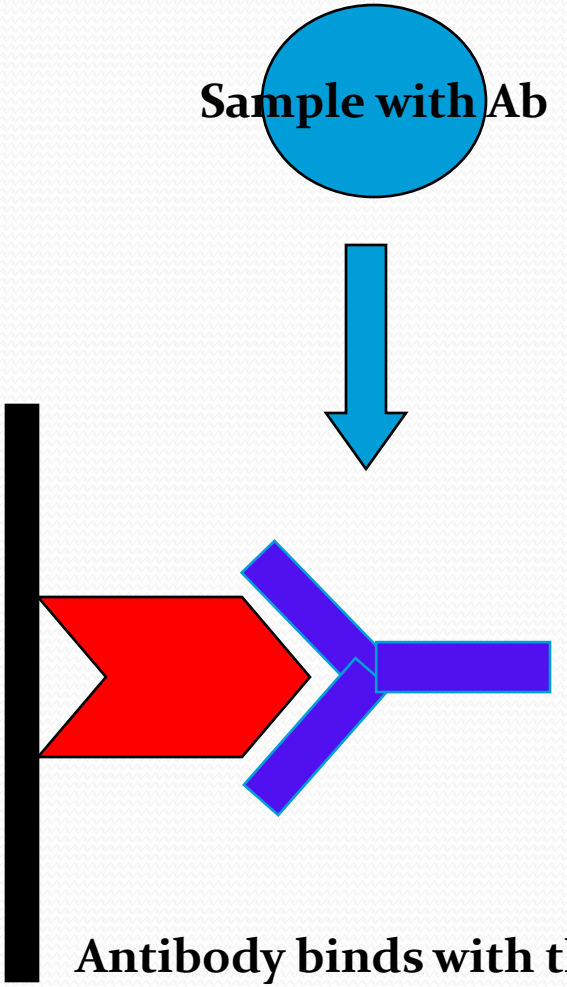
Antibody

HRP

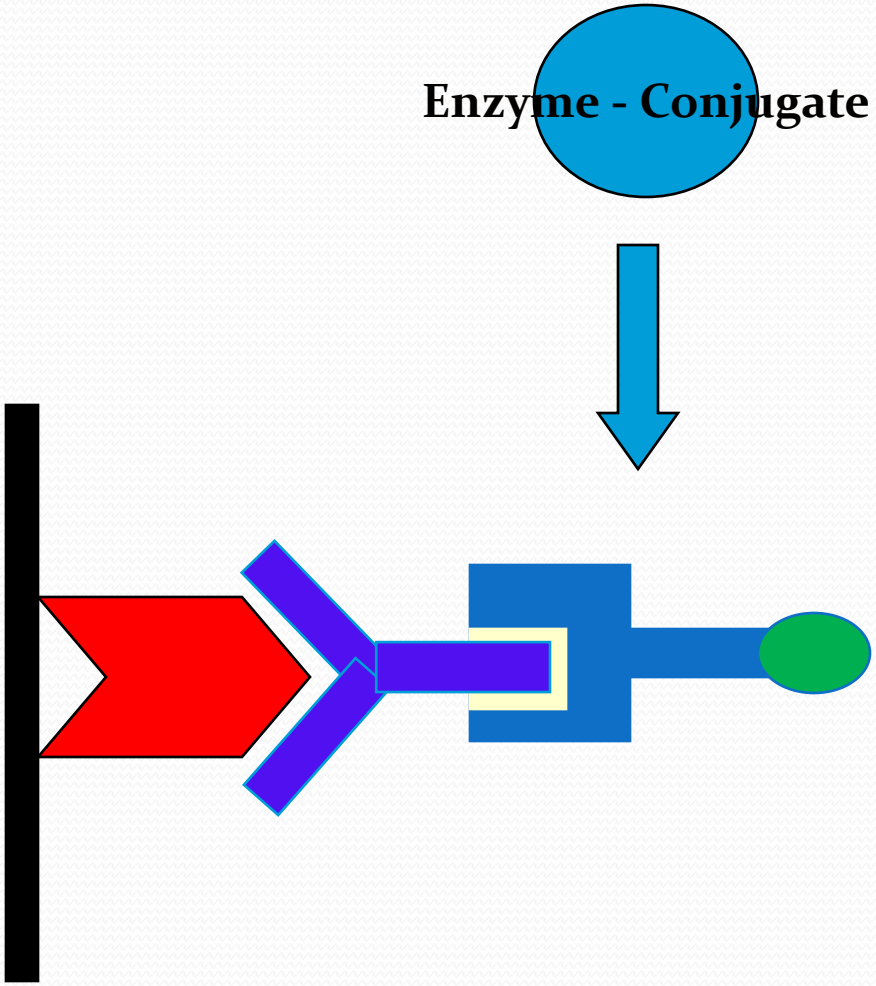
Conjugate (antibody tagged to HRP)



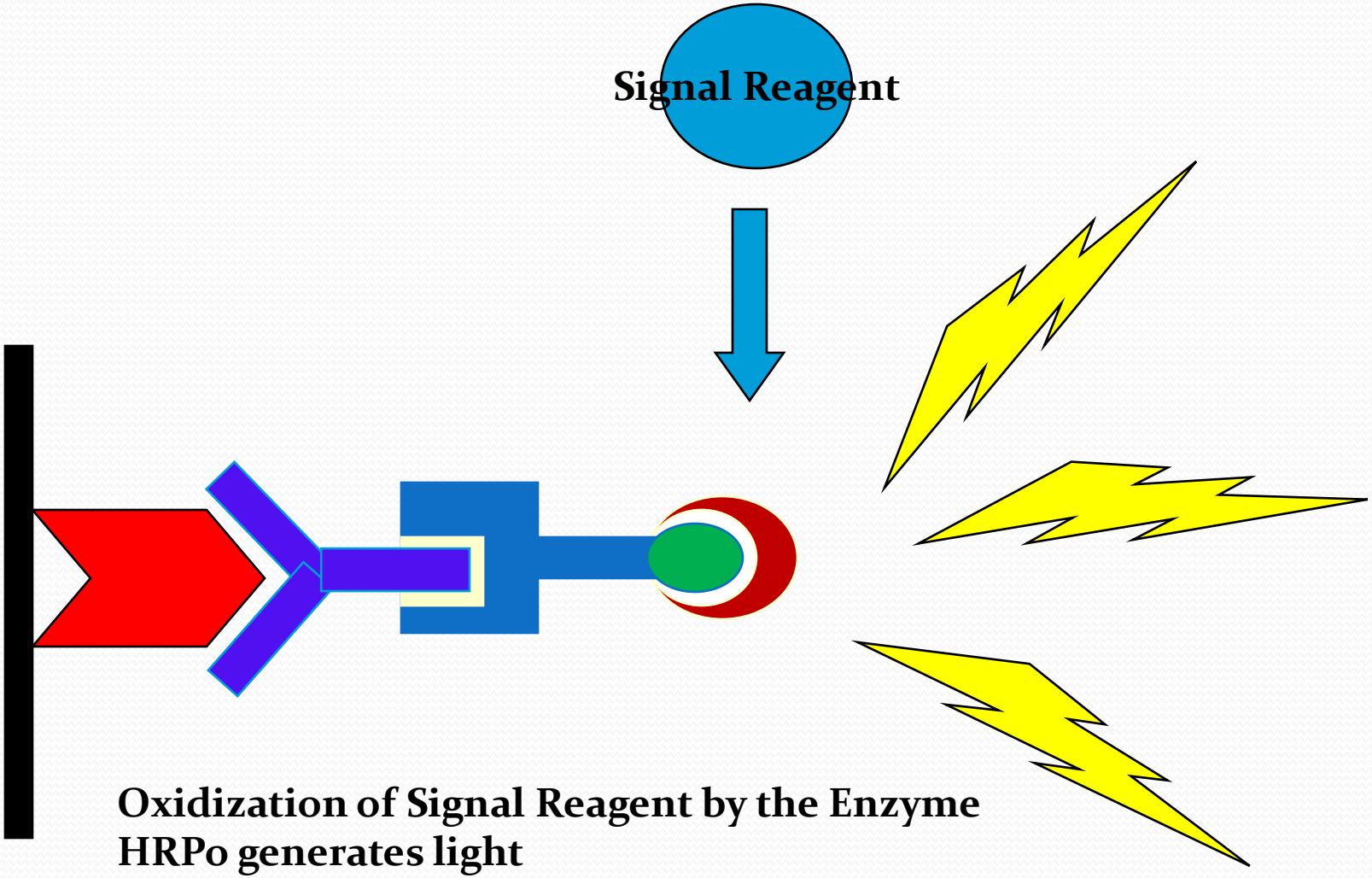
Signal Reagent



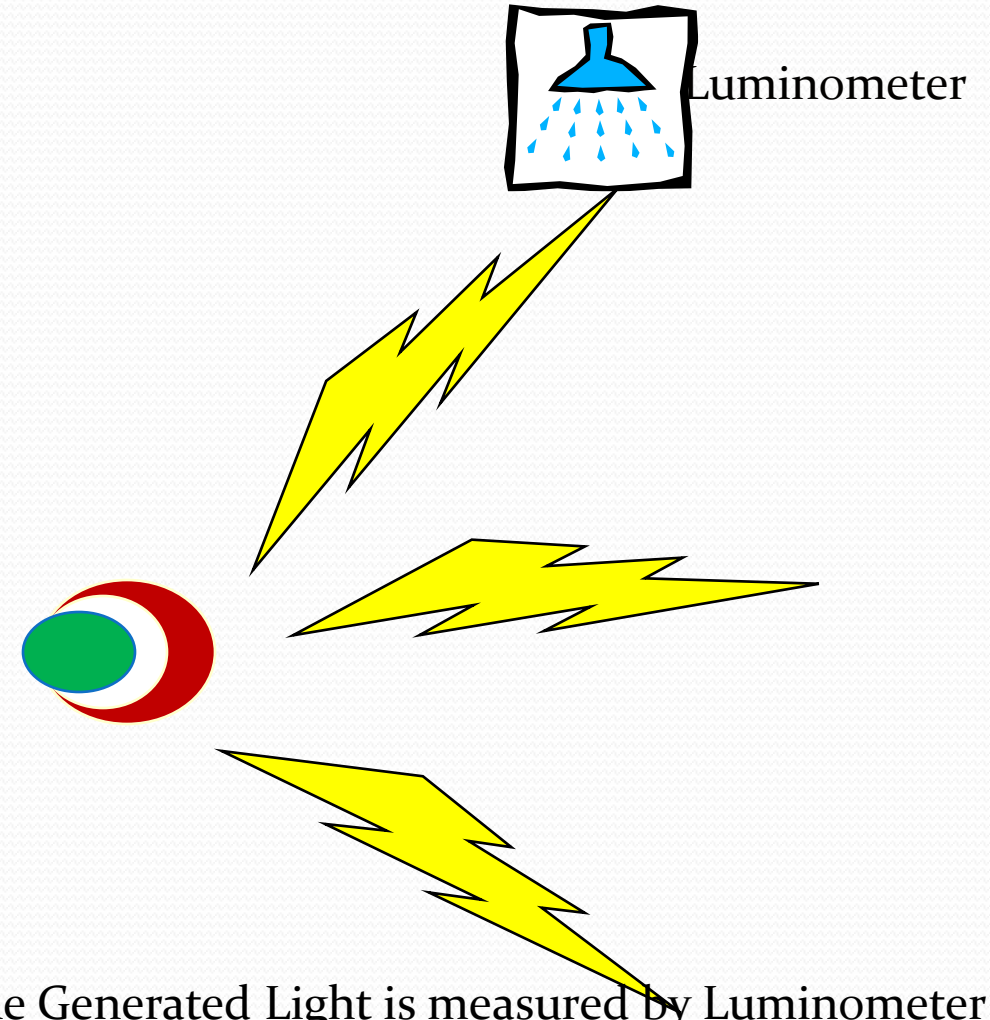
Antibody binds with the coated antigen on the well



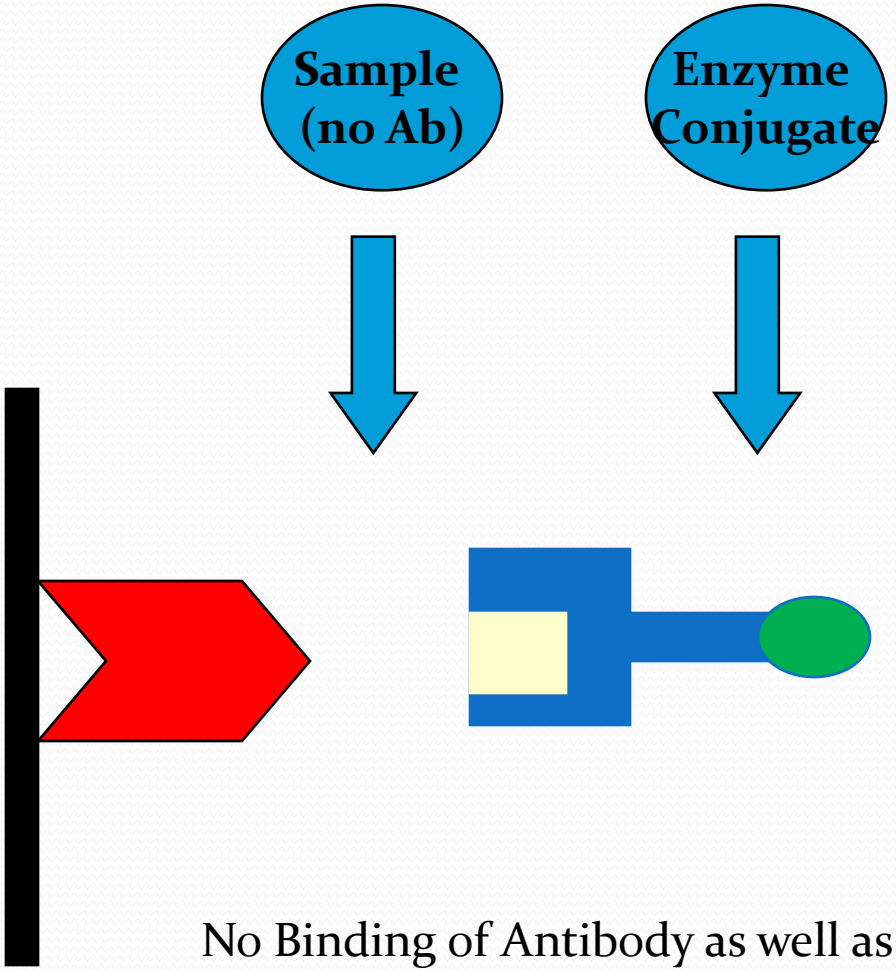
The Enzyme Conjugate binds with the Antibody



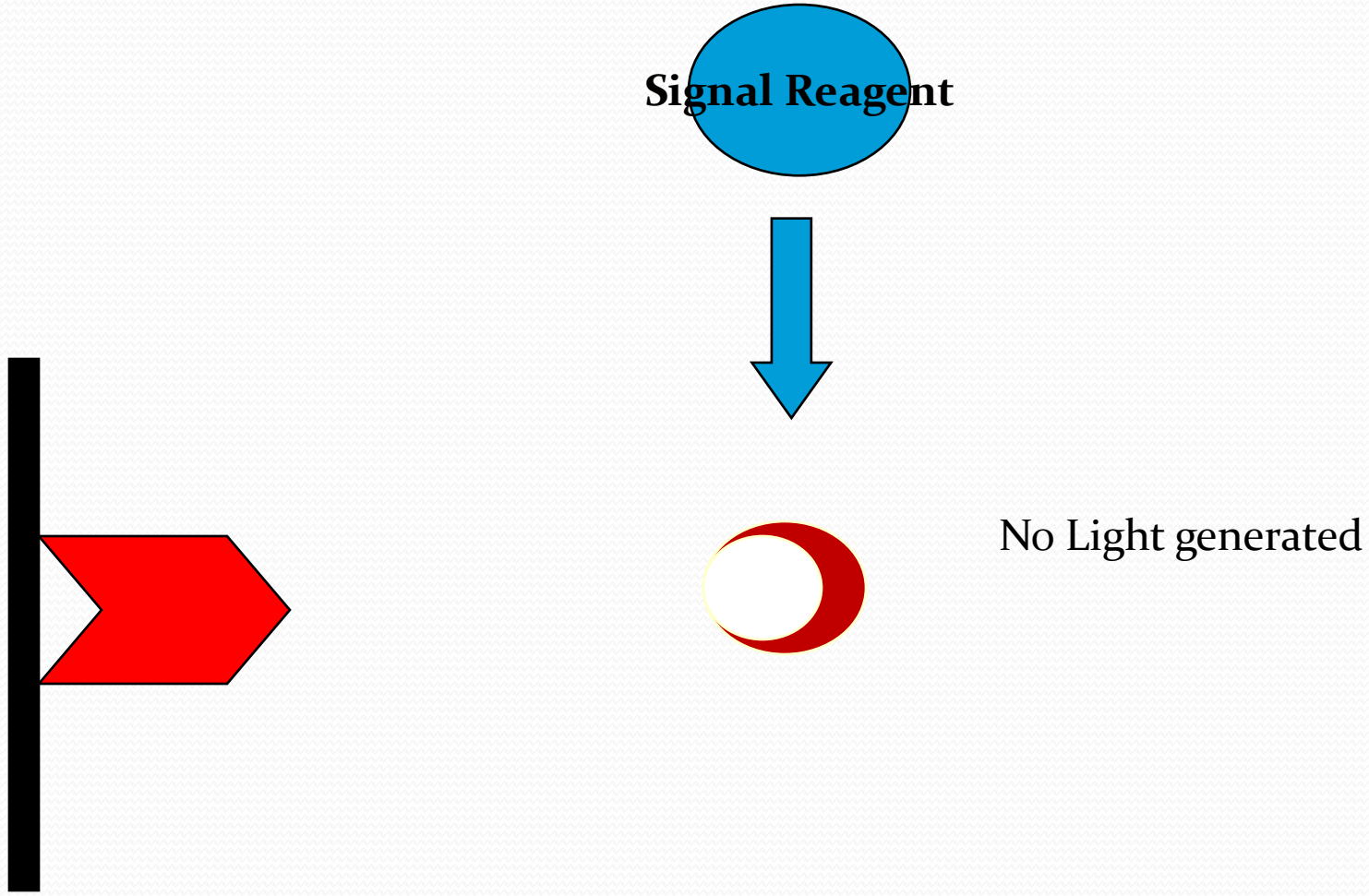
Oxidization of Signal Reagent by the Enzyme HRPo generates light



The Generated Light is measured by Luminometer



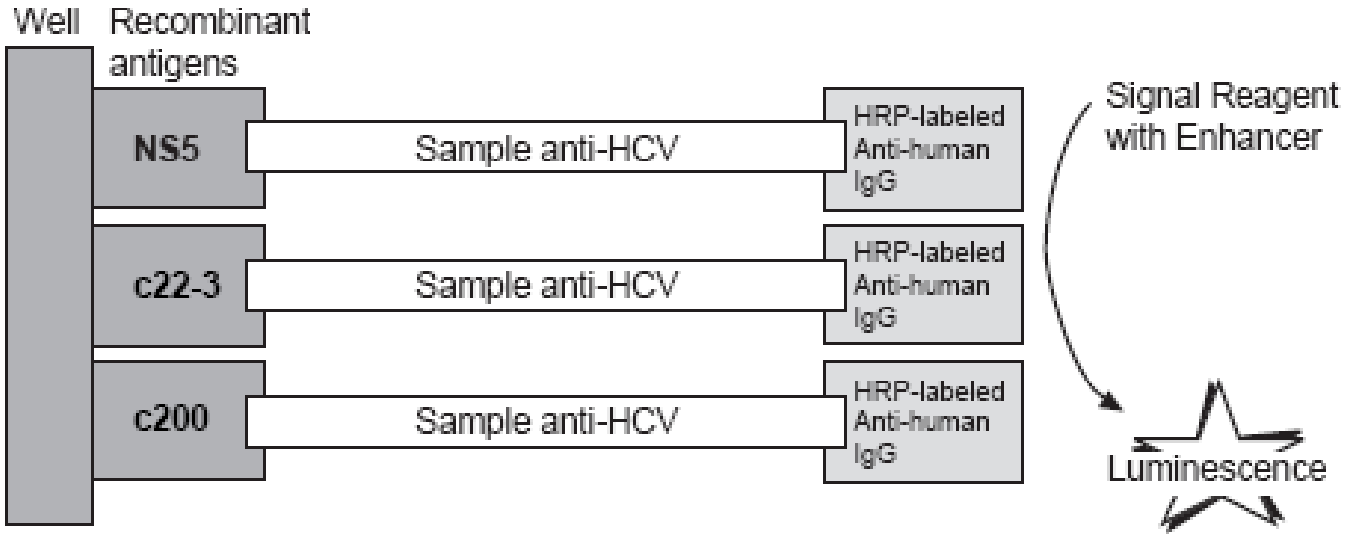
No Binding of Antibody as well as Conjugate



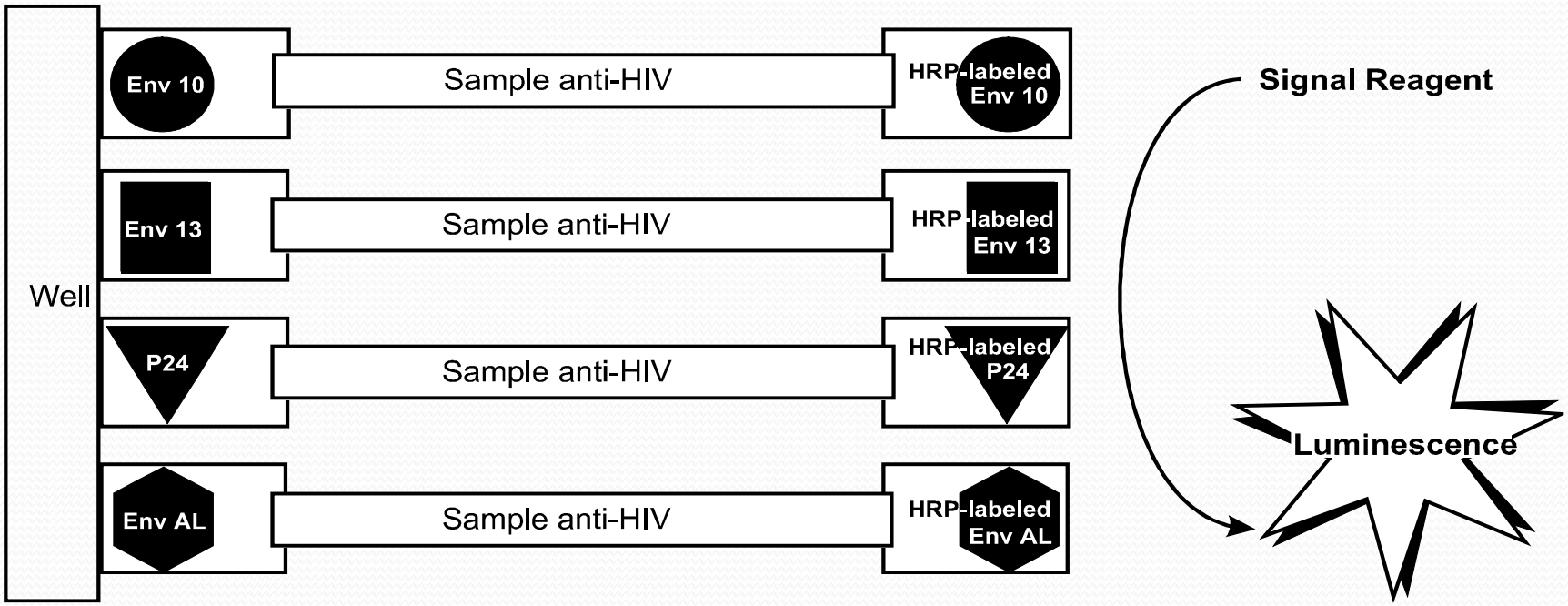
Negative reaction

Vitros HCV –
Antigen – Anti antibody- Sandwich Assay

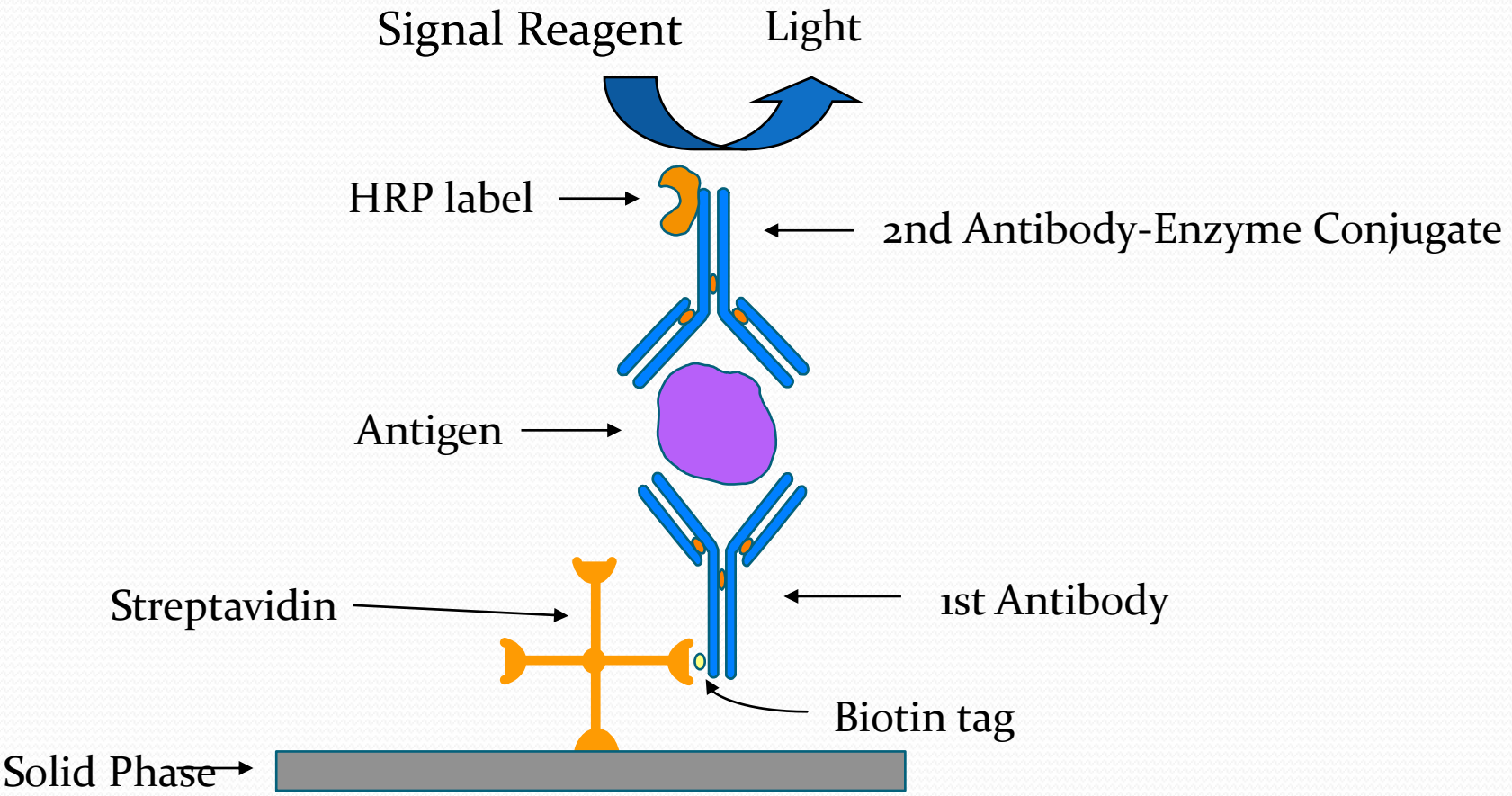
Reaction Scheme



Vitros HIV – Antigen Sandwich Assay

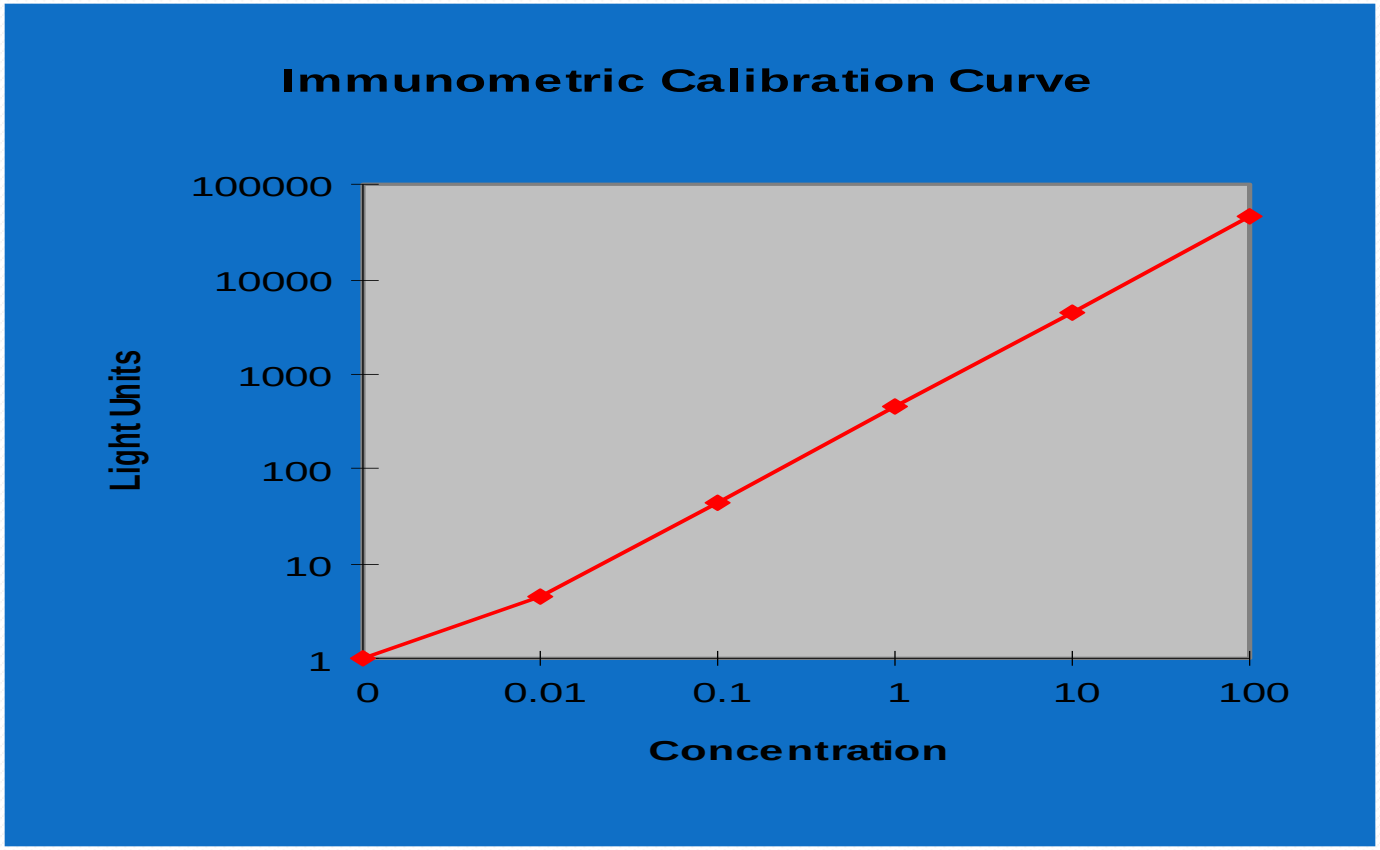


Immunometric Assay for the detection of antigen on Streptavidin Coated Well

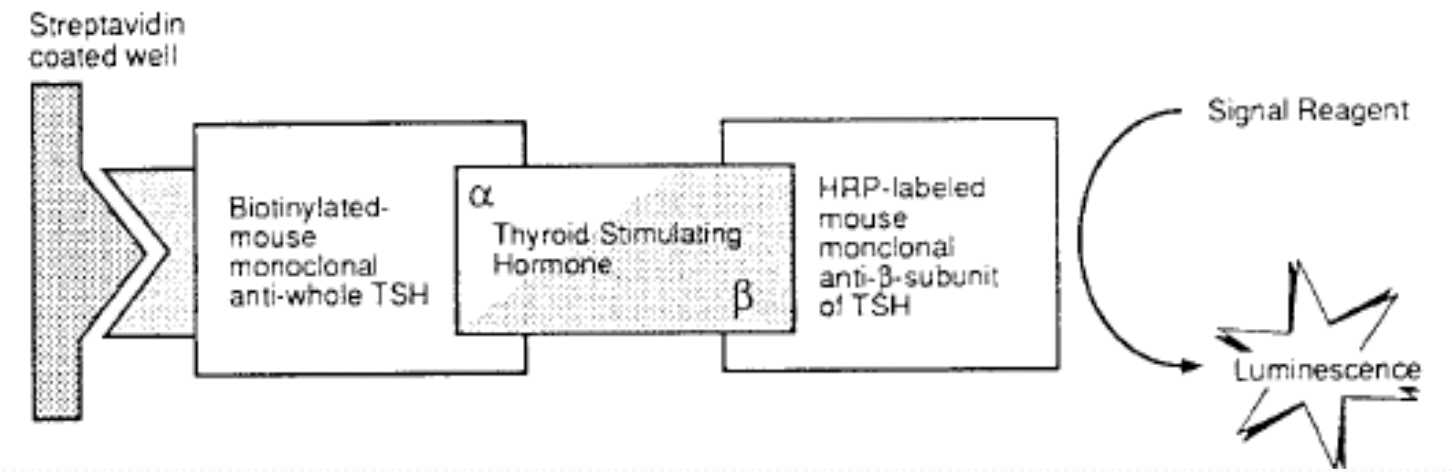


Quantitative Assay

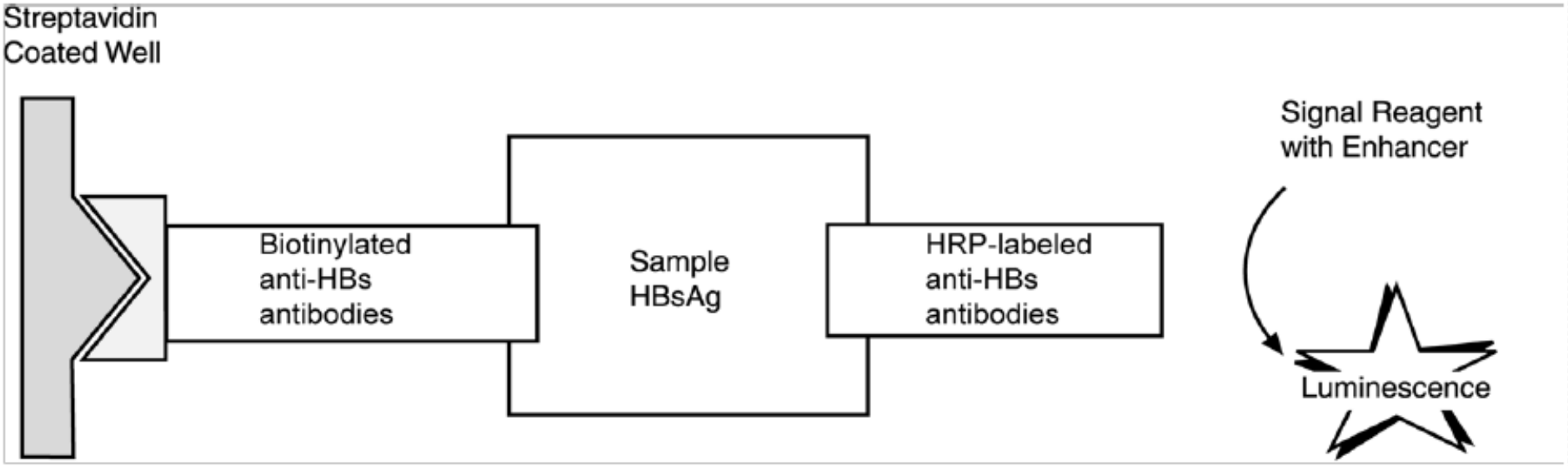
The amount of labeled antibody binding will be *proportional* to the total amount of analyte present in the patient sample.



Vitros TSH – An example of Immunometric assay



VITROS® HBsAg ES



Principles of the Procedure

Antibody – Antigen – Antibody Sandwich assay
with Streptavidin – biotin complex incorporation

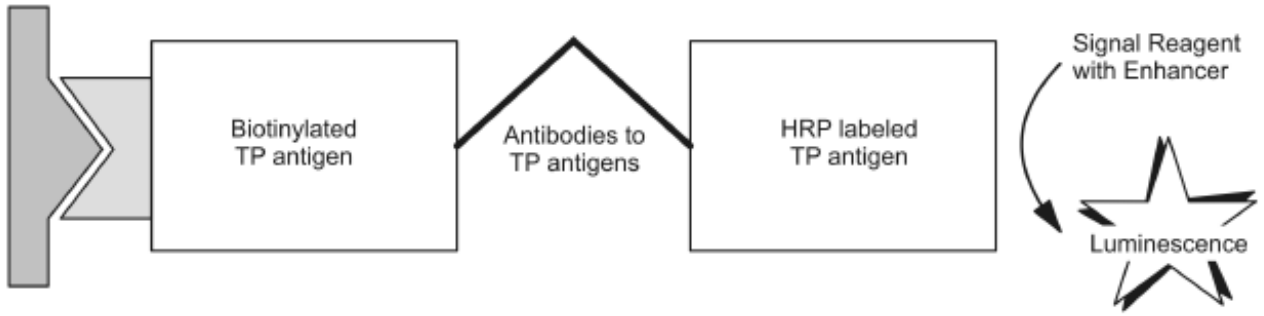
VITROS Syphilis Assay –

Double antigen Sandwich assay

Test Type	System *	Incubation Time	Time to first result	Test Temperature	Reaction Sample Volume
Immunometric	ECi/ECiQ, 3600, 5600	16 mins first incubation 8 mins second incubation	35 minutes	37 °C	25 µL

* Not all products and systems are available in all countries.

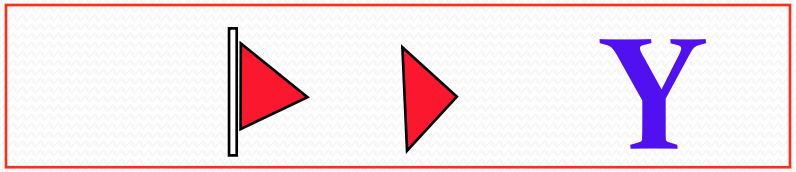
Reaction Scheme



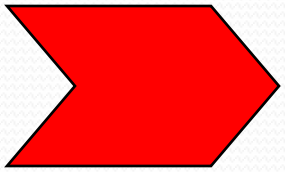
Tp Specific IgM antibody – Second week of infection
Tp Specific IgG antibody – Fourth week of infection

Competitive Assay

- Competitive Assay ?
- For the detection of antigen which are small molecule.

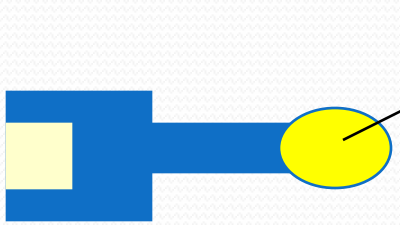


Basic Principle of Competitive Assay

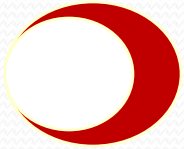


Antigen

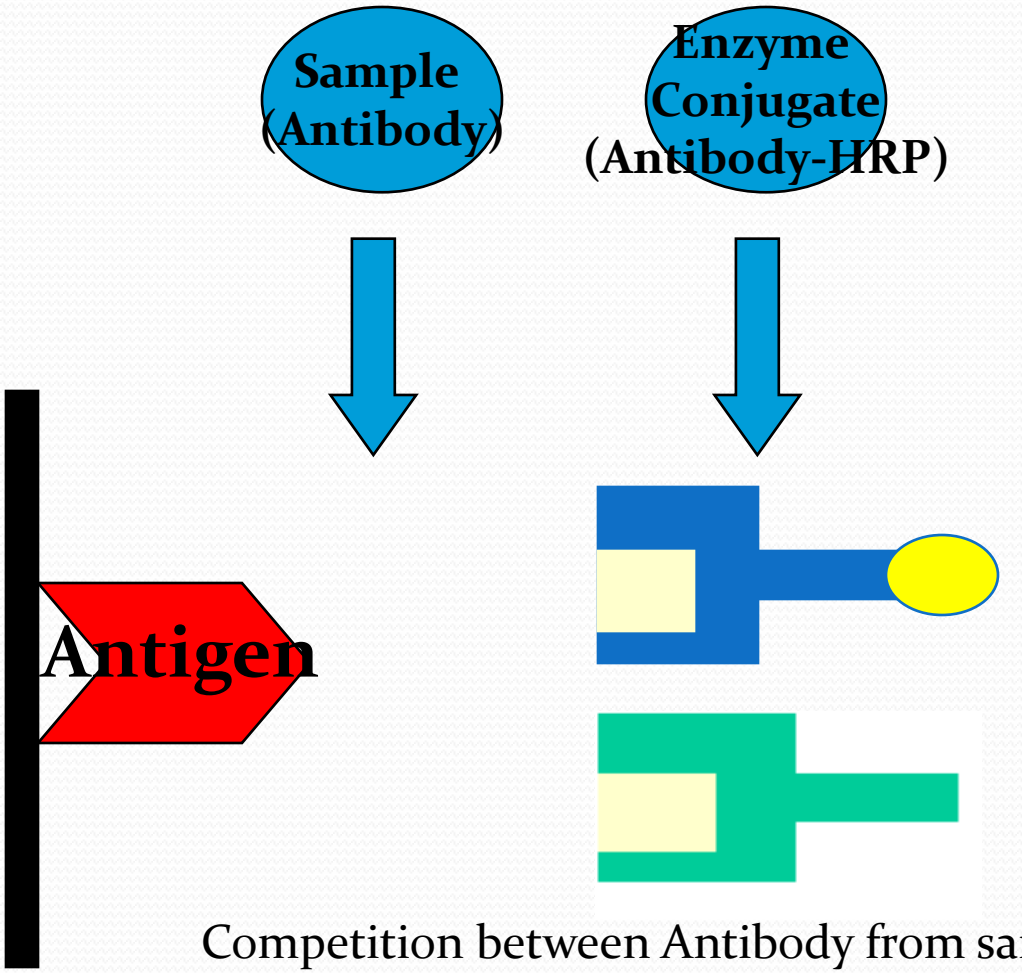
Antibody



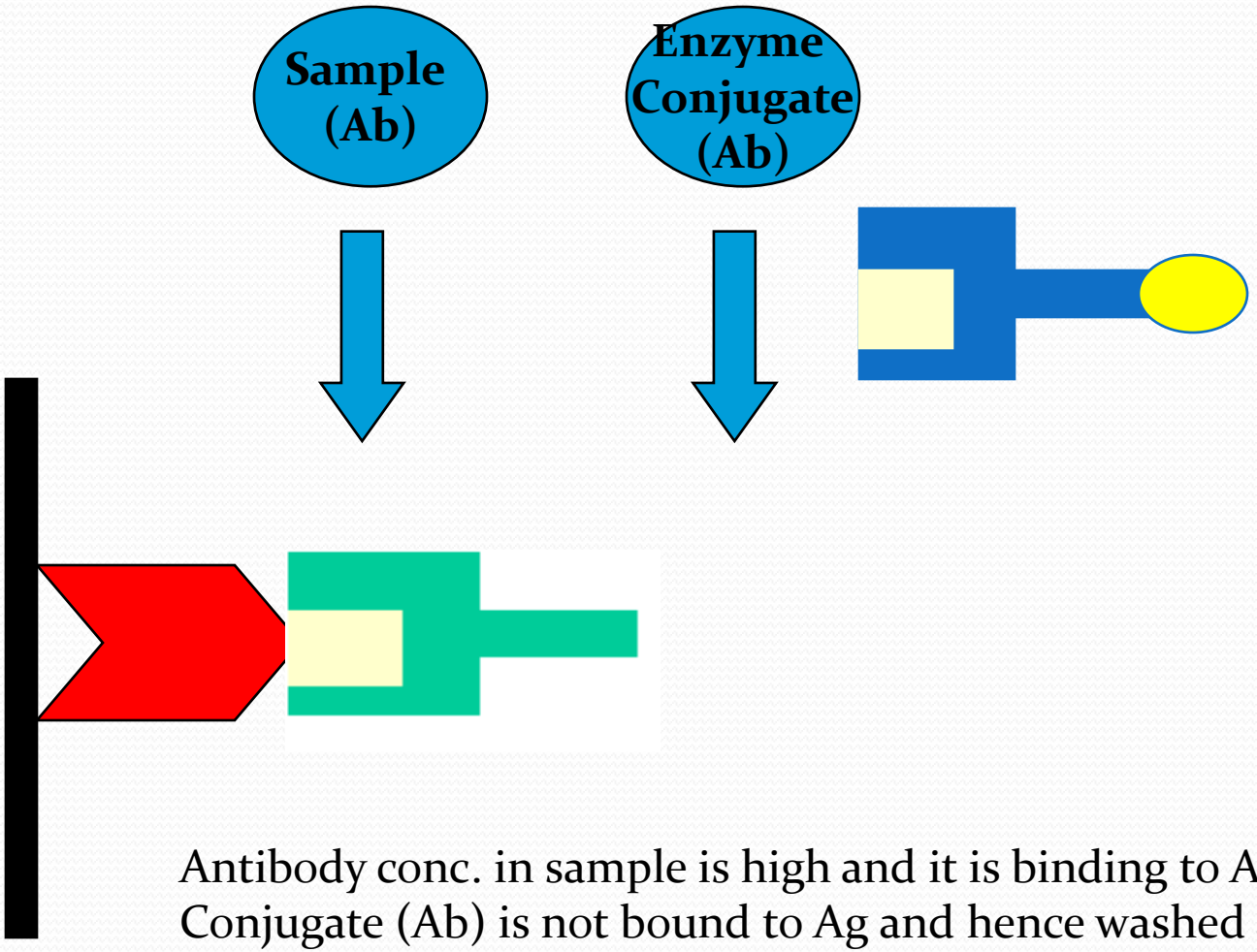
Conjugate (Antibody tagged to HRP)



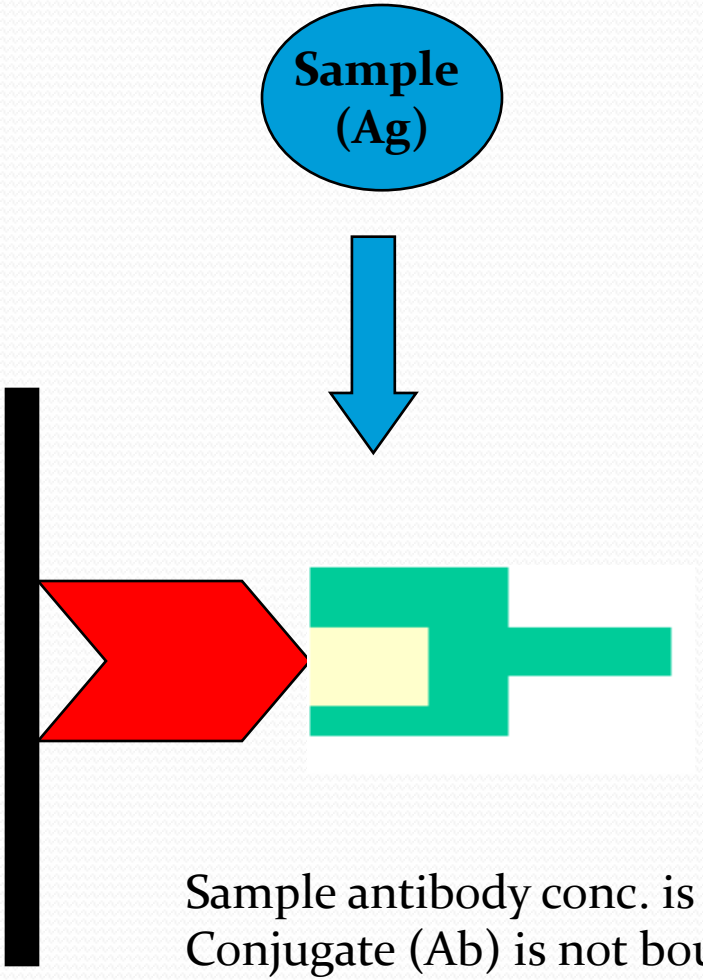
Signal Reagent



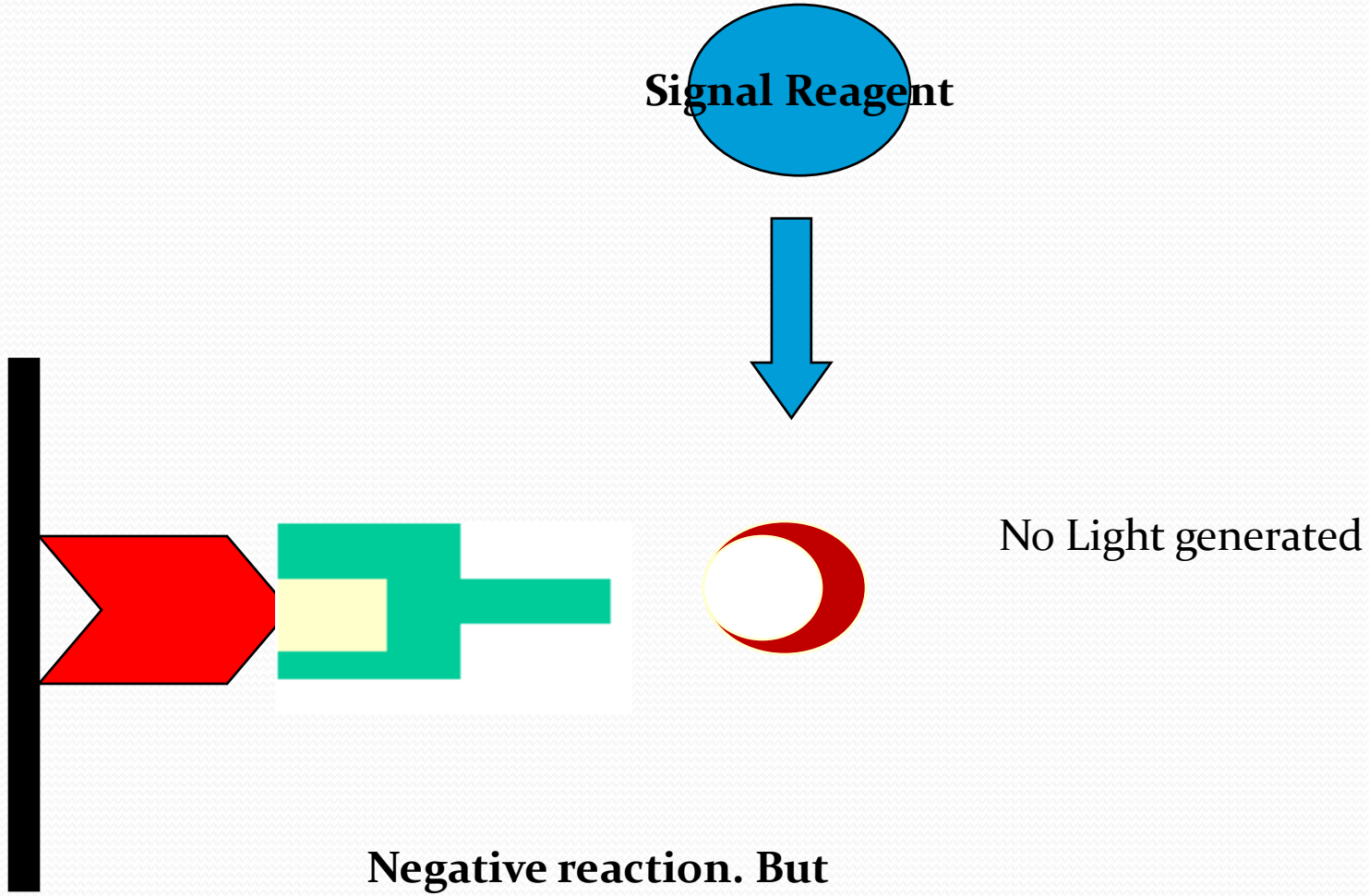
Competition between Antibody from sample and Antibody from conjugate for the limited Ag



Antibody conc. in sample is high and it is binding to Ag.
Conjugate (Ab) is not bound to Ag and hence washed away



Sample antibody conc. is high and it is binding to Antigen.
Conjugate (Ab) is not bound to Ag and hence washed away



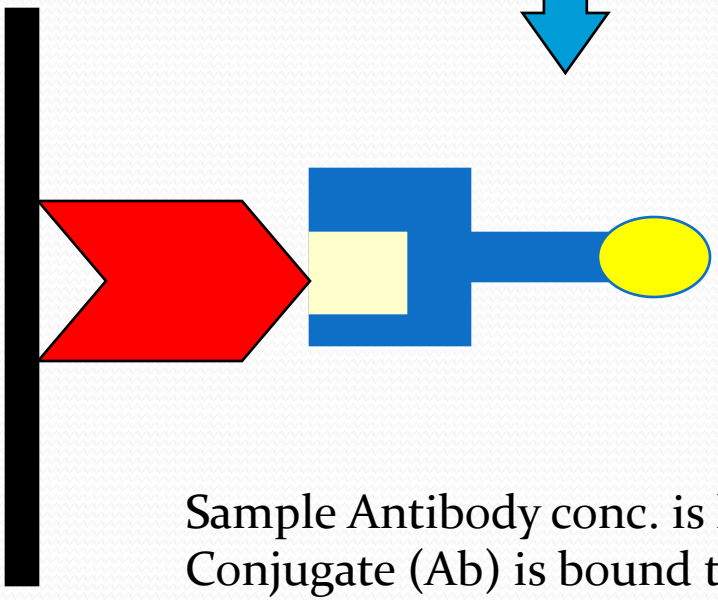
Negative reaction. But

Positive for Antibody presence.

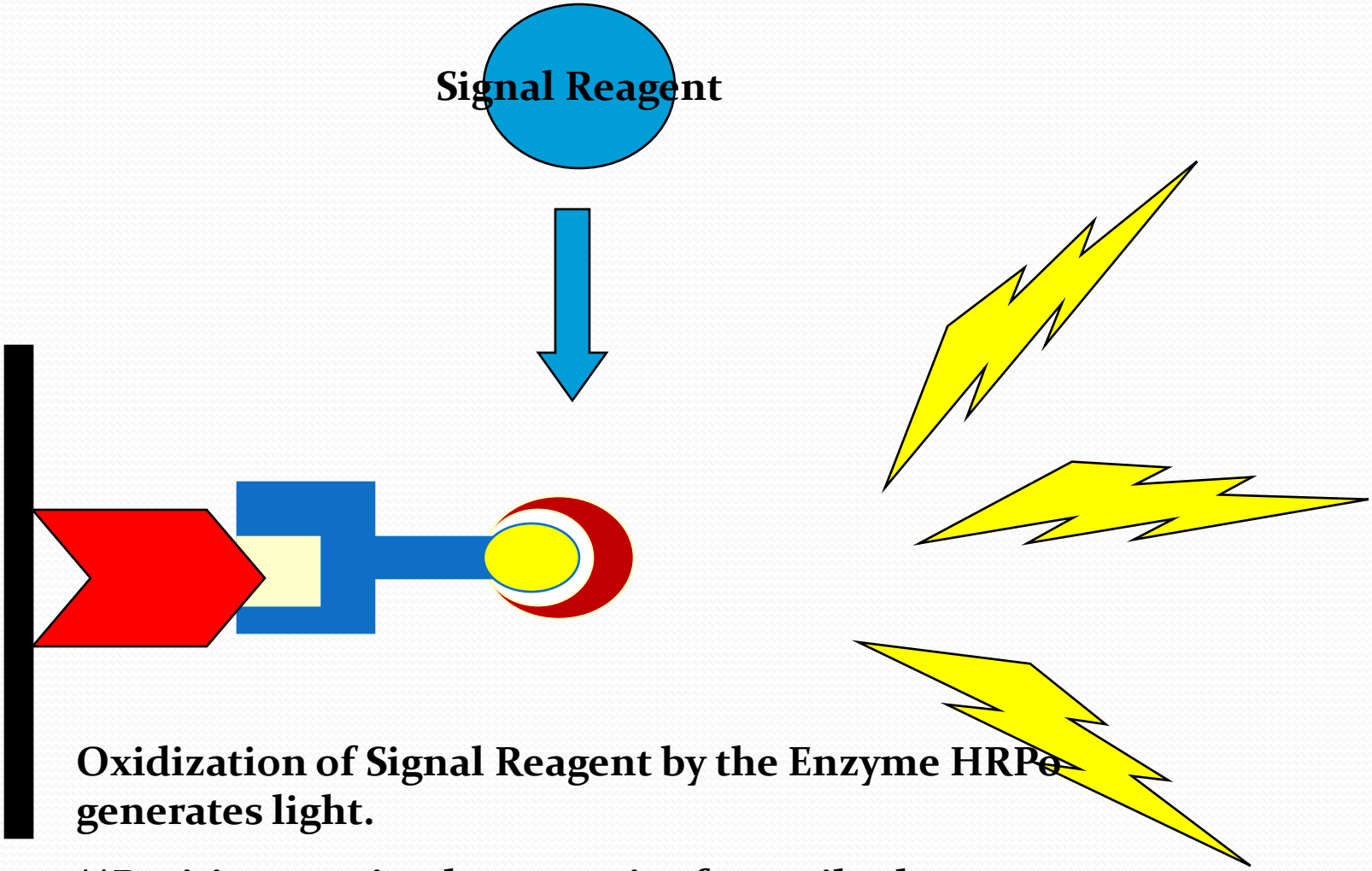
Sample (Ag)

Enzyme Conjugate (Ag)

Low conc.



Sample Antibody conc. is low or nil and it is not binding to Ag.
Conjugate (Ab) is bound to Ag.

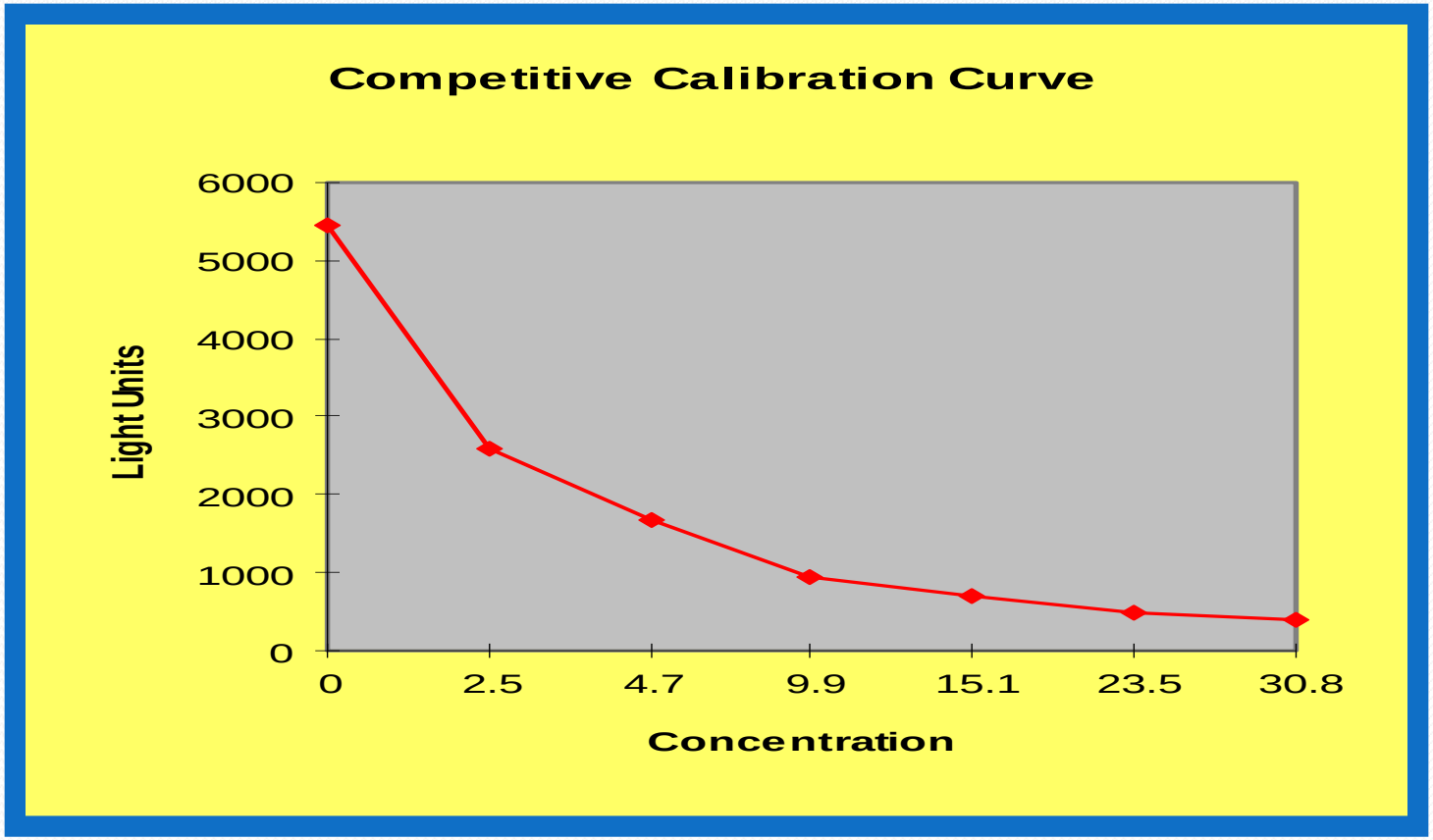


Oxidization of Signal Reagent by the Enzyme HRPo generates light.

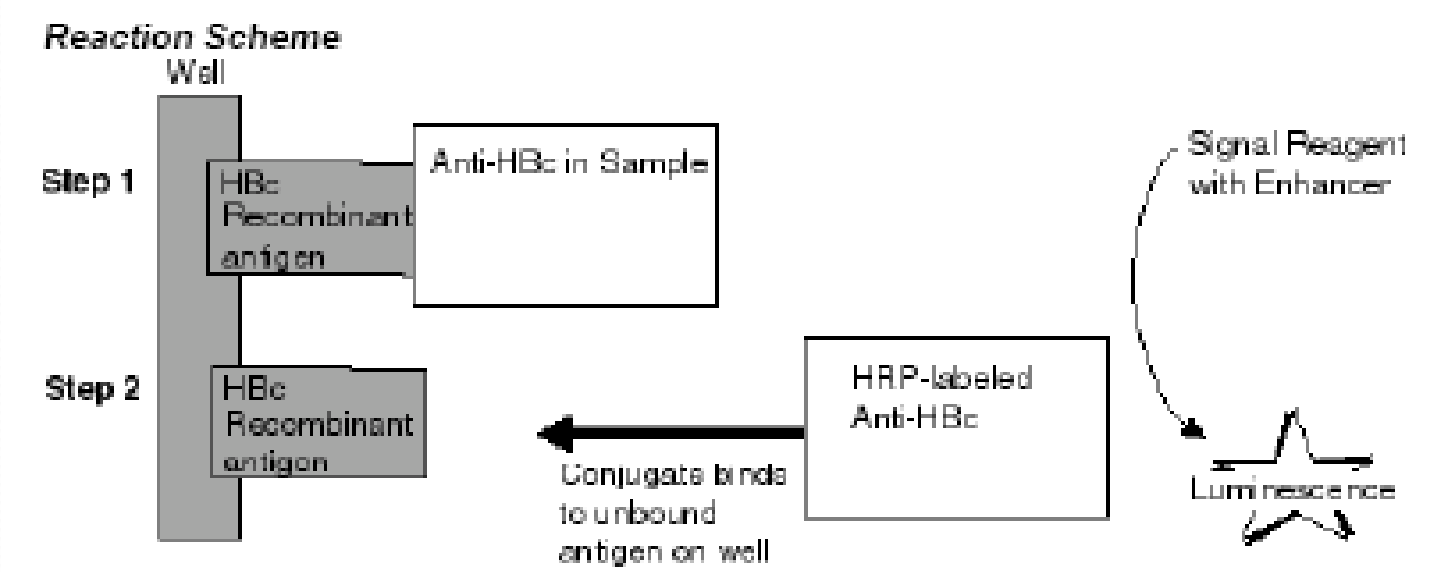
****Positive reaction but negative for antibody**

Quantitative assay – Competitive format

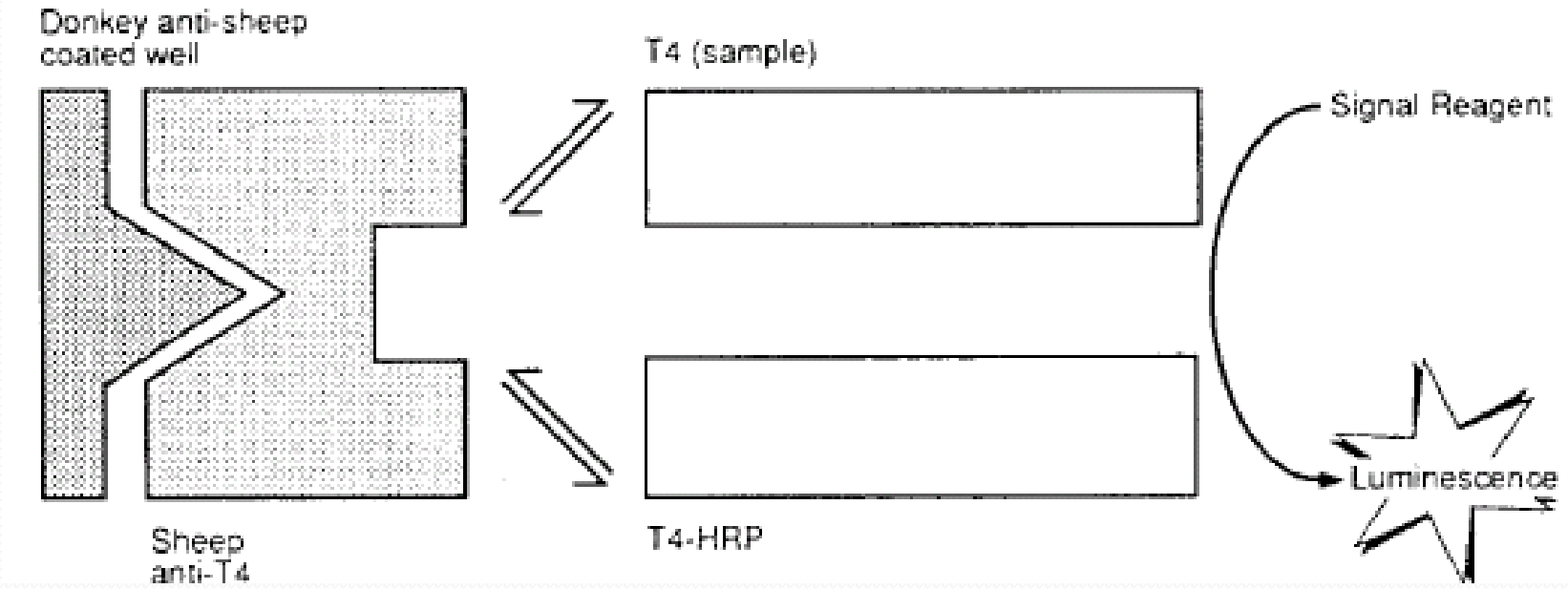
The amount of labeled analyte bound to the antibody is *inversely proportional* to the concentration of the unlabeled analyte in a patient sample.



Vitros Anti HBc Ab – Competitive assay for the detection of Antibody



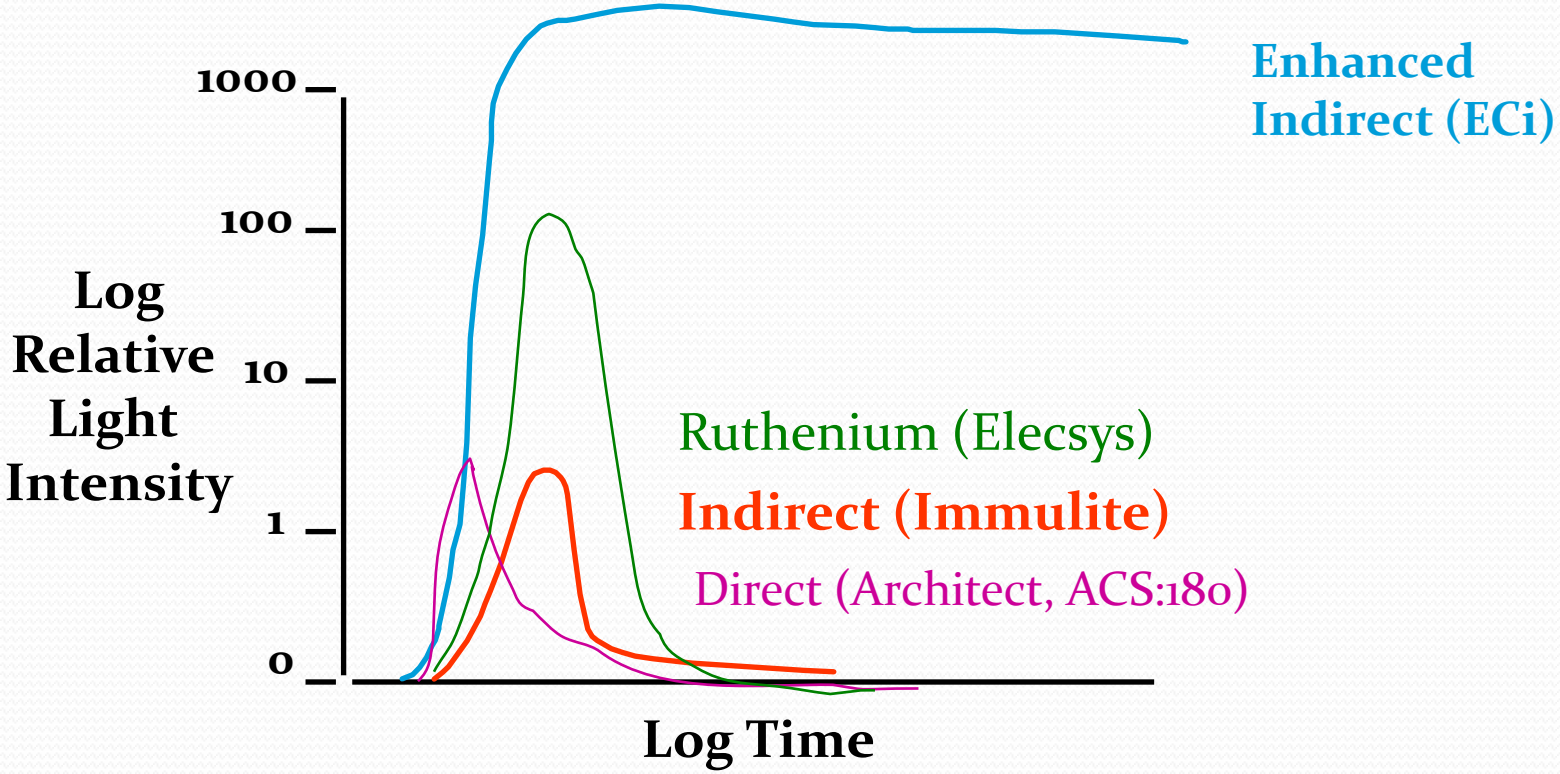
Vitros T4 – an example for Competitive Assay for Antigen detection



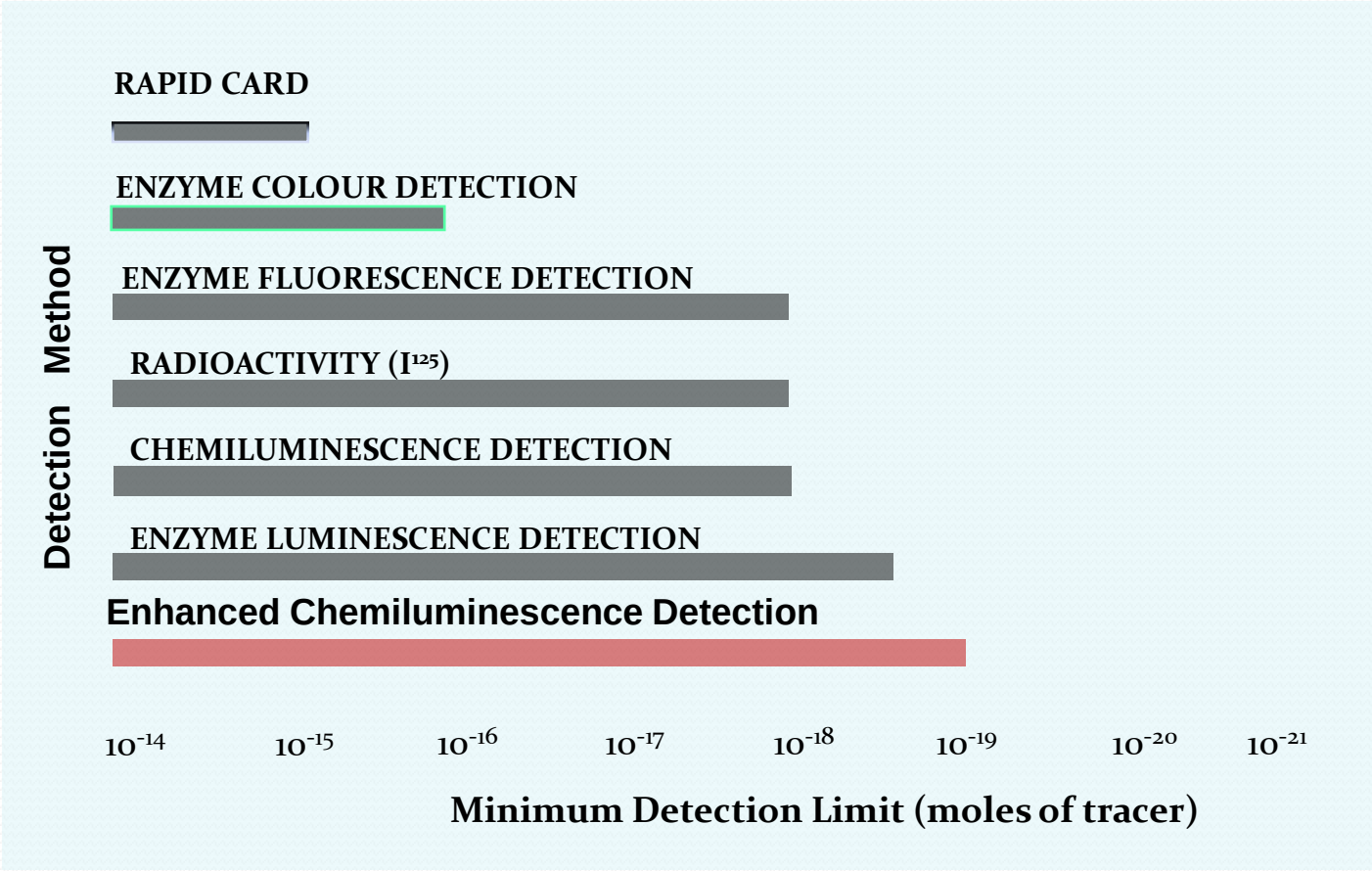
Enhanced Chemiluminescence

- **Significantly improved signal output (light) compared to conventional direct and indirect chemiluminesence provides for:**
  - **Superior analytical sensitivity and precision**
  - **Broader assay dynamic range**
  - **Small sample volume requirements**

Enhanced Chemiluminescence



Enhanced Chemiluminescence – Comparison with other techniques



Chemiluminescence (CLIA)

- Enhanced chemiluminescence enables earlier detection than other existing immunoassay methods
- Enhanced sensitivity – narrow window period
- Uncompromised specificity
- Quick TAT helps in emergency situation.
- Automation & Ease of use is an overt advantage


integrity by
intelli check™

Challenge in the Laboratory…

….Reduce errors

- Pre and Post analytical variables
  - **Primary tube sampling**
  - **No sample splitting**
  - **Sample Integrity verification**
  - **Bi-directional interfacing with LIS for sample programming and reporting**
  - **Auto-verification for standardized reporting**
- Analytical variables
- **Process Review and releasing Report**

Preventable Errors Abound…

June 14, 2006

Hospitals Move to Cut Dangerous Lab Errors

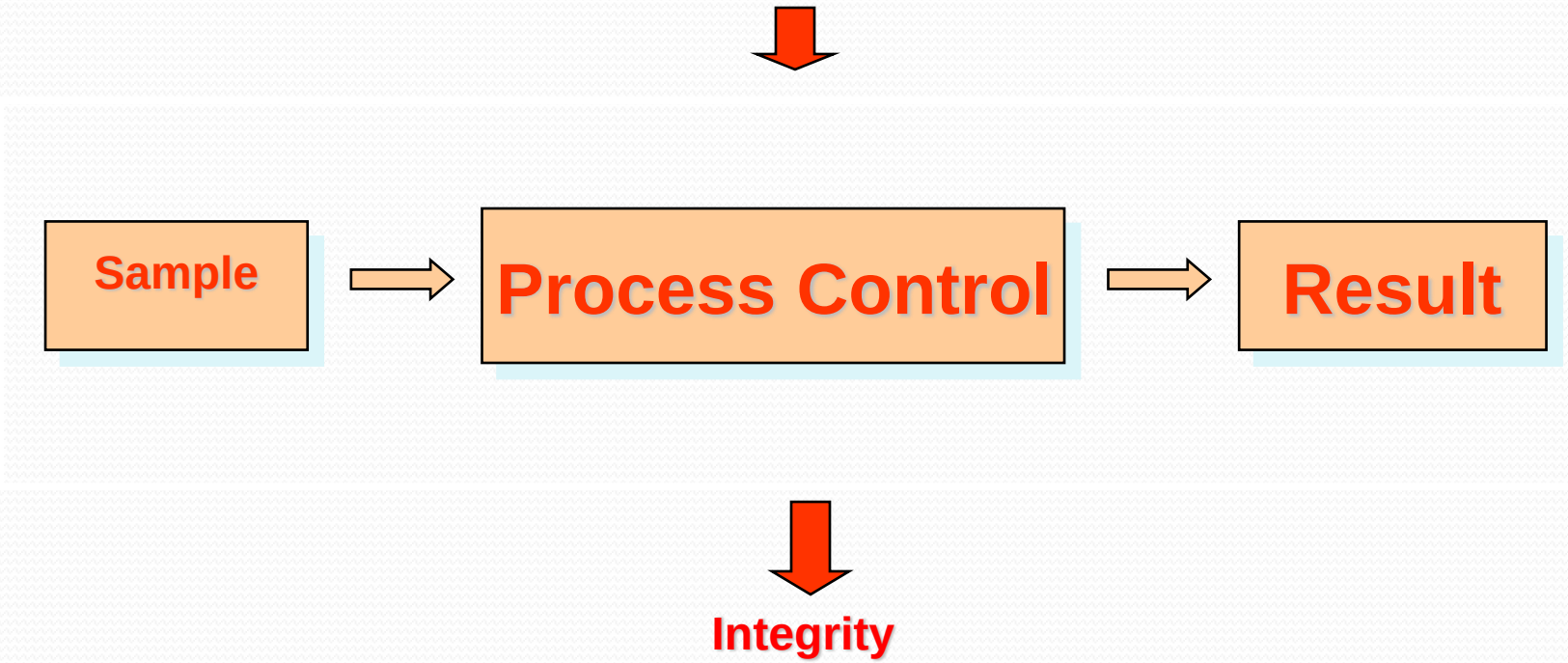
Improved Specimen Collection And Efficiency Help Increase Accuracy of Medical Testing

June 14, 2006; Page D1

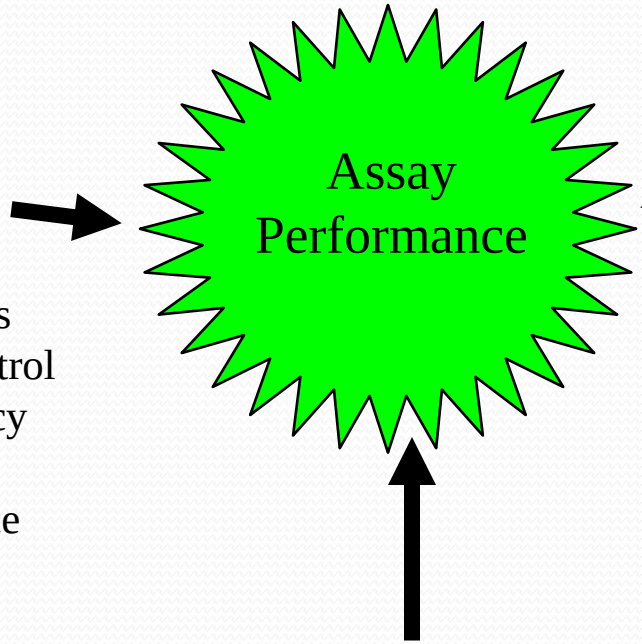
Diagnosed with a deadly neuroendocrine cancer at age 34, Kim Tutt was told she might have just months to live. After five surgeries to excise a cyst under her gum, remove her lower jaw and teeth, and reconstruct her face with bone taken from her lower leg, the Tyler, Texas, mother of two heard some shocking news: The slides from the biopsy of her cyst had been contaminated by cells from another patient, and she had never had cancer in the first place.

"… 3 to 5% of specimens taken each year are defective… blood that isn't drawn correctly… mix-up with another patient's sample"

- Science based Innovative technological advancements contribute to medical error reduction



VITROS System: Bringing it all together



SYSTEM

- Incubation Times
- Flexible Protocols
- Temperature Control
- Metering Accuracy
- Reliability
- Wash Performance

MEASURING TECHNOLOGY

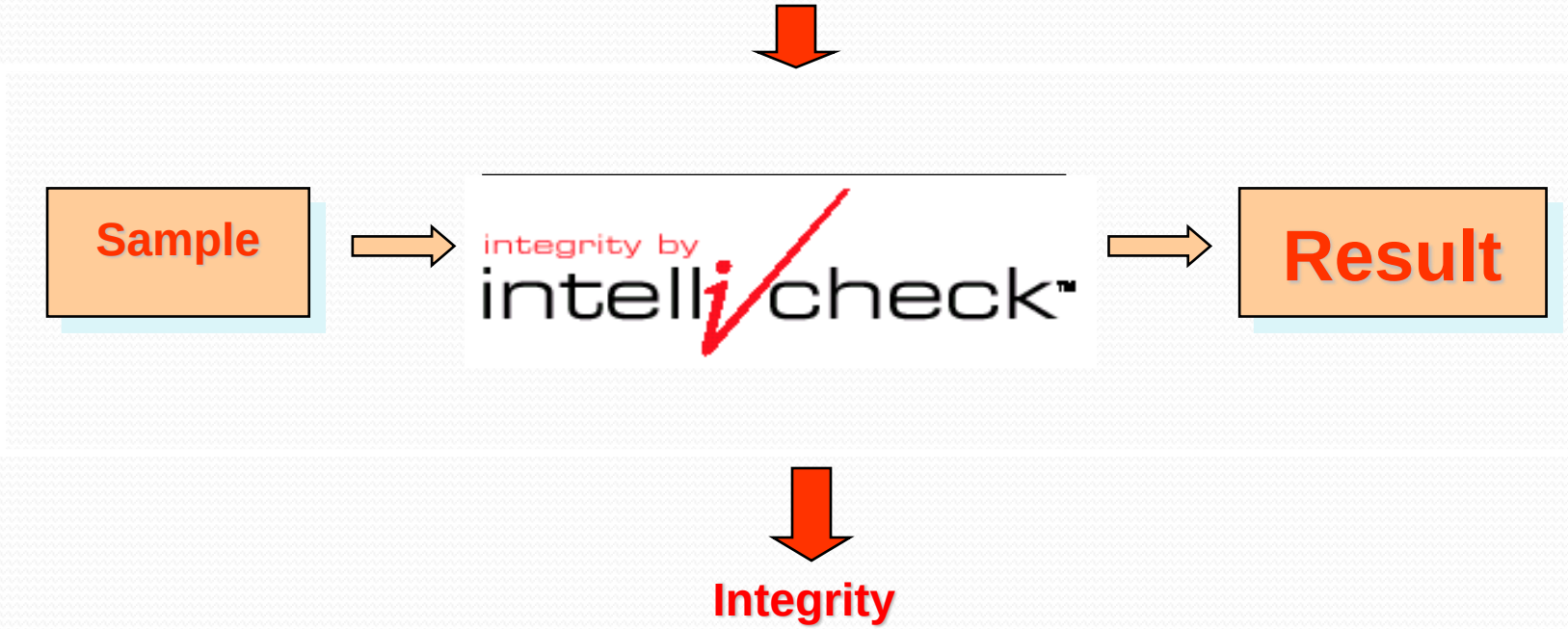
- Enhanced Chemiluminescence
- Micro-Wells
- Range
- Sensitivity
- Precision

ASSAY DESIGN

- Antibody Selection
- Quality
- Purity of Antigen
- Buffer Formulation

To enhance the Laboratory process .....

Ortho-Clinical Diagnostics is set to the challenge of reduction of error in the process?



What is Intellicheck™ Technology?

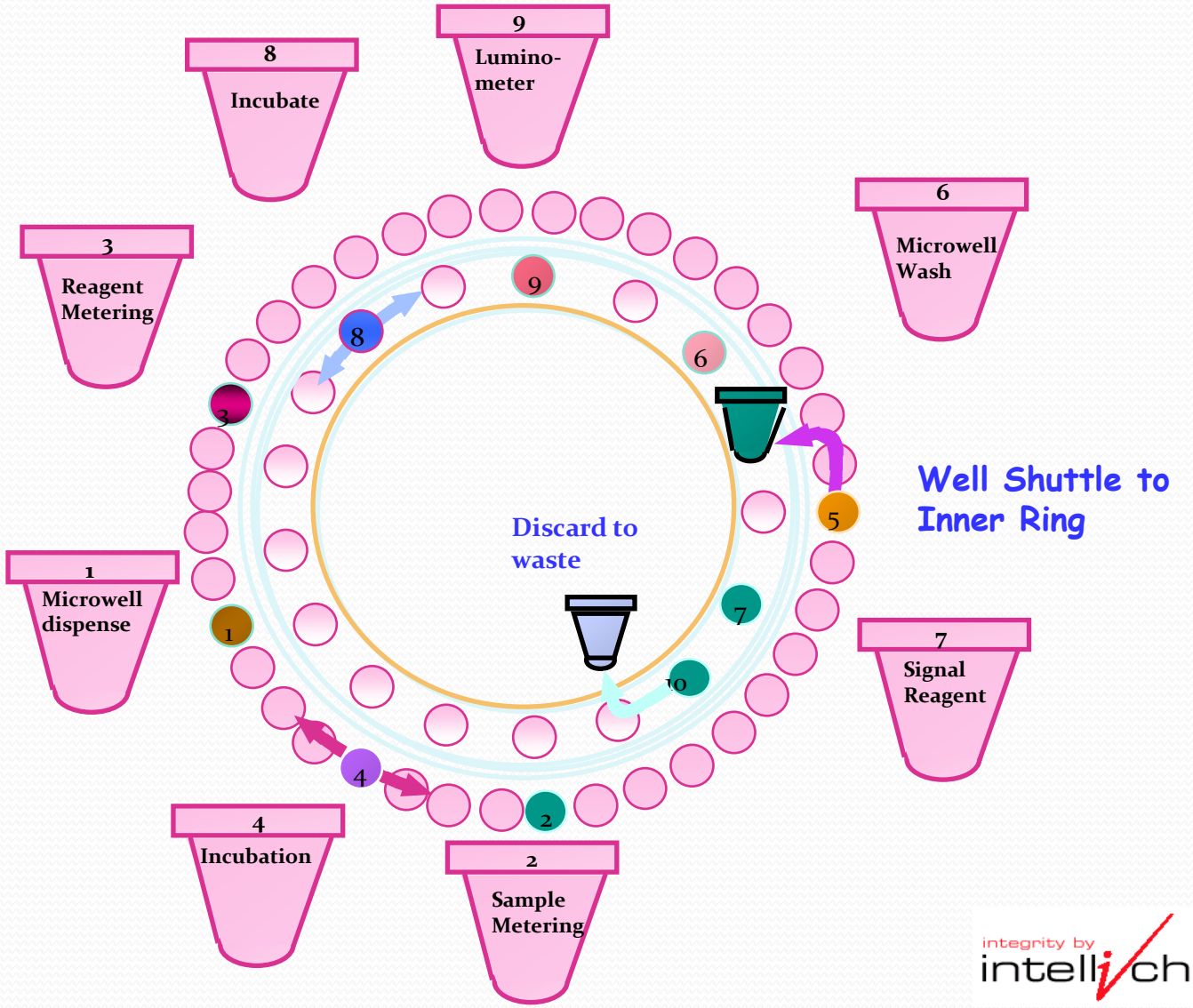
"Intellicheck Technology" is a series of unique and patented technologies that provide integrated Process Control

- performs, monitors and verifies diagnostic checks throughout sample and assay processing

Intellicheck Technology for Microwell assay

- Sample Metering
- Sample Indices
- Sample Dilution
- Reagent Metering
- Signal Reagent Metering
- Well Wash
- Luminometer

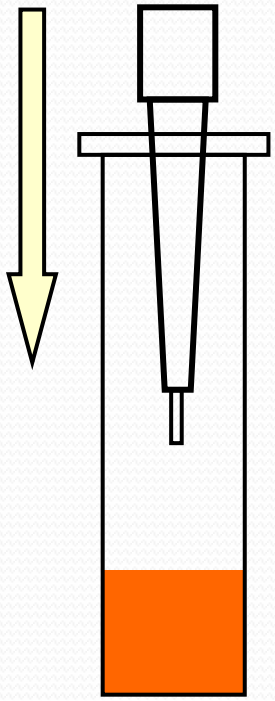
Steps - "Journey of the Well"



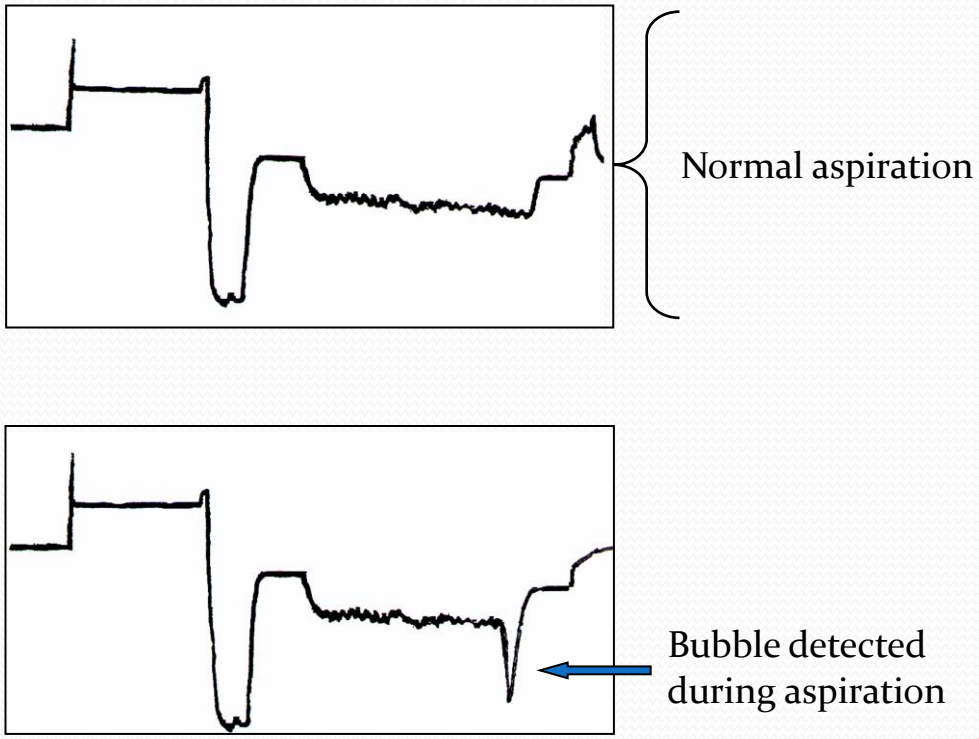
Sample Metering

Disposable Tip Sample Metering

Patented Pressure/Level Sensing Technology



Aspiration Pressure Profiles

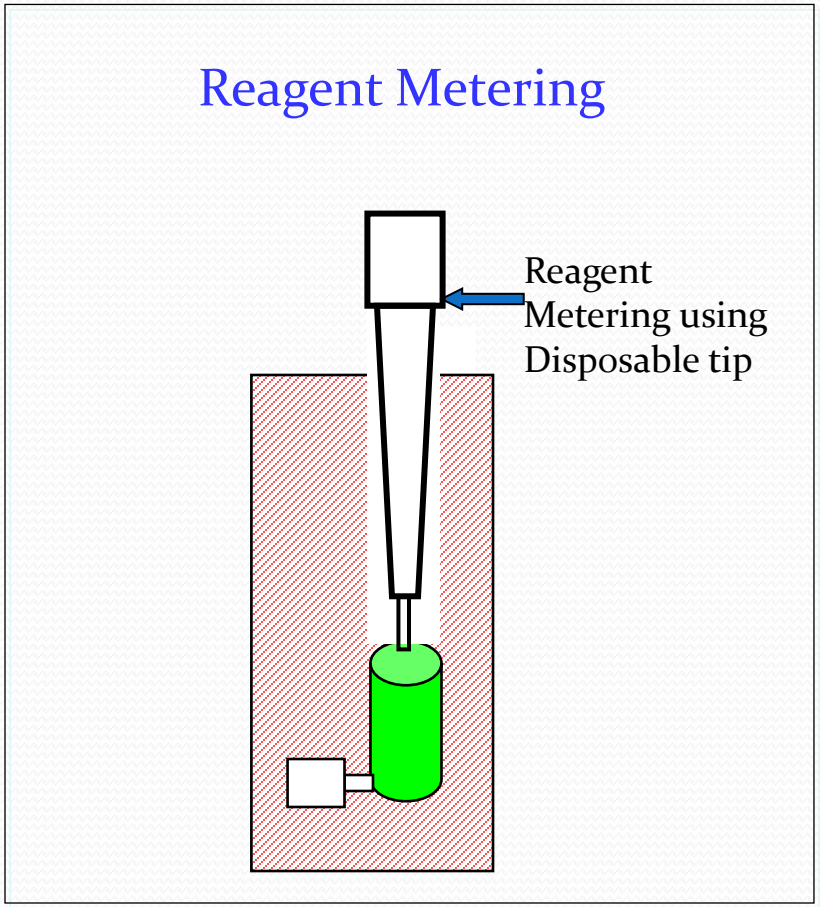


integrity by intelli check™

Reagent Metering

Reagent Metering Verification

- Verifies subsystem performance before aspiration and dispense
- Patented process
- Eliminates the potential for a misreported result by not processing an assay when an exception is detected
- Ensures result integrity



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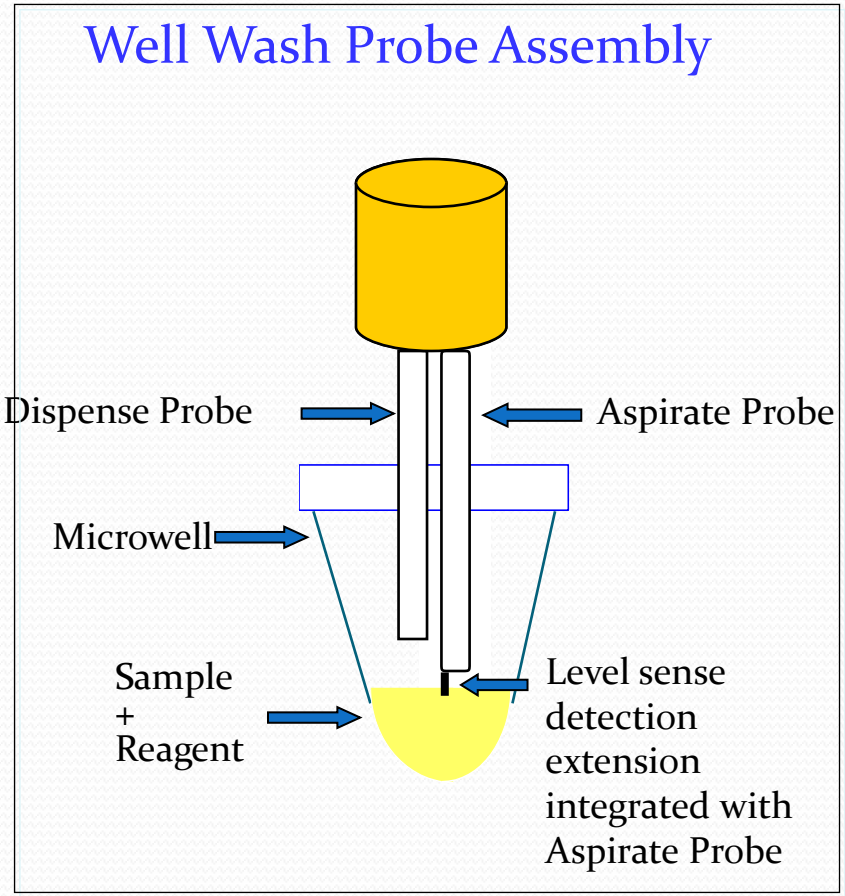
Reagent Metering

Sample + Reagent Verification

- **Sample + Reagent volume verification**
  - **Ensures results integrity**

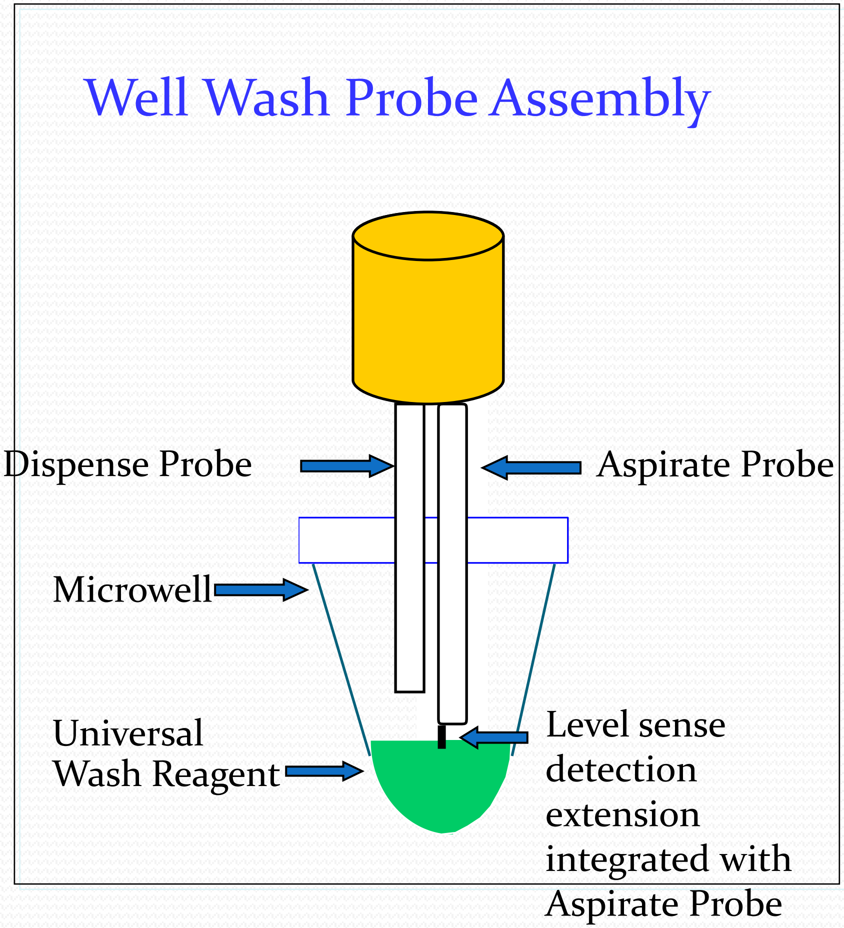


integrity by intelli check™

Well Wash

Well Wash Dispense Verification

- **Verification of proper Universal Wash Reagent volume dispensed and removed from the Microwell**
- **Level sensing technology**
- **Eliminates the potential for a misreported result by not processing an assay when an exception is detected**
- **Detection with automatic recovery including maintaining continuous, walkaway operation**
- **Ensures result integrity**



integrity by intellicheck™

Signal Reagent

Signal Reagent Dispense Verification

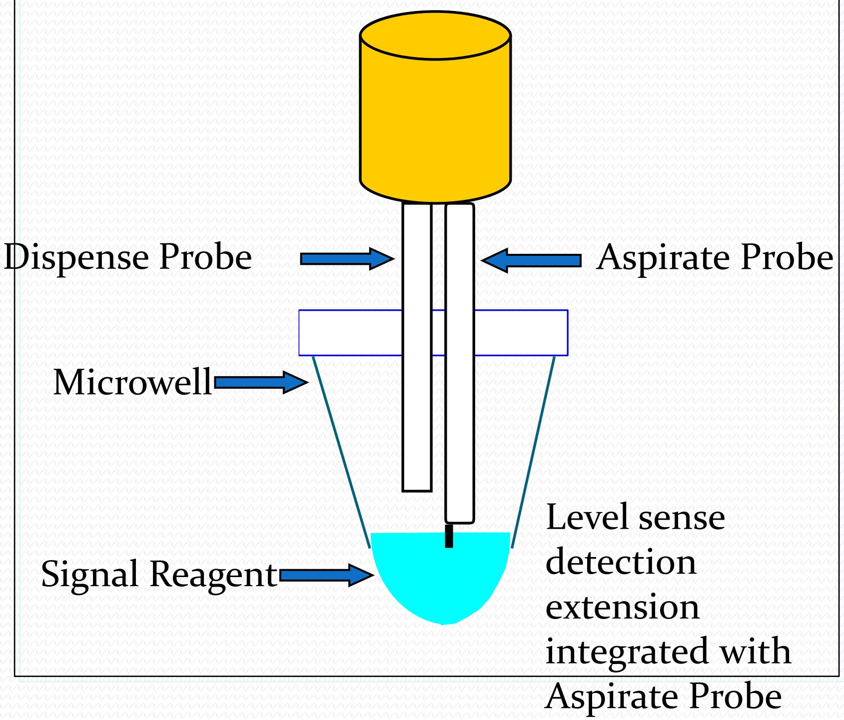
Signal Dispense Verification

- Verification of proper Signal Reagent volume dispense into the Microwell
- Level sensing technology

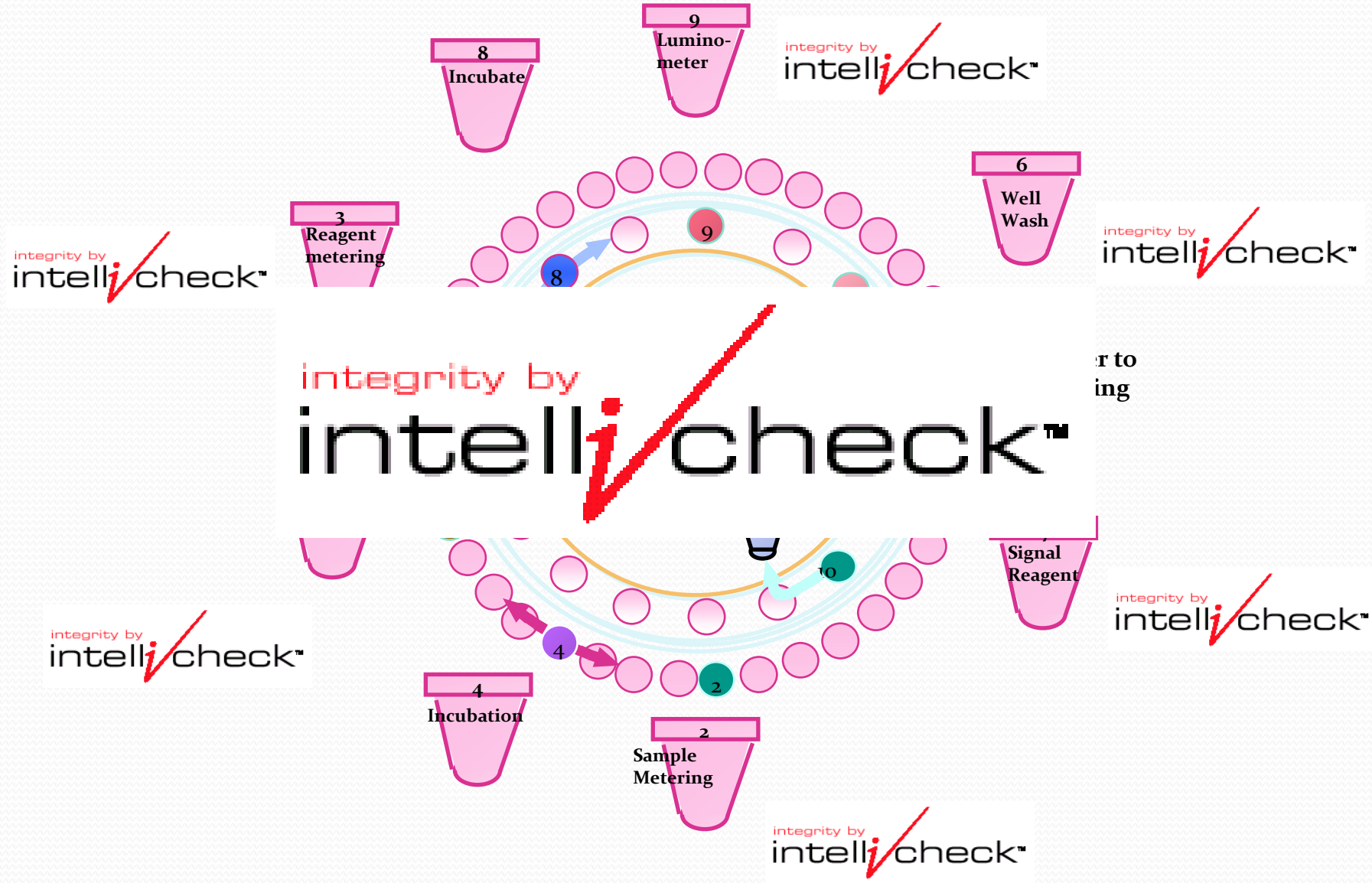
Luminometer

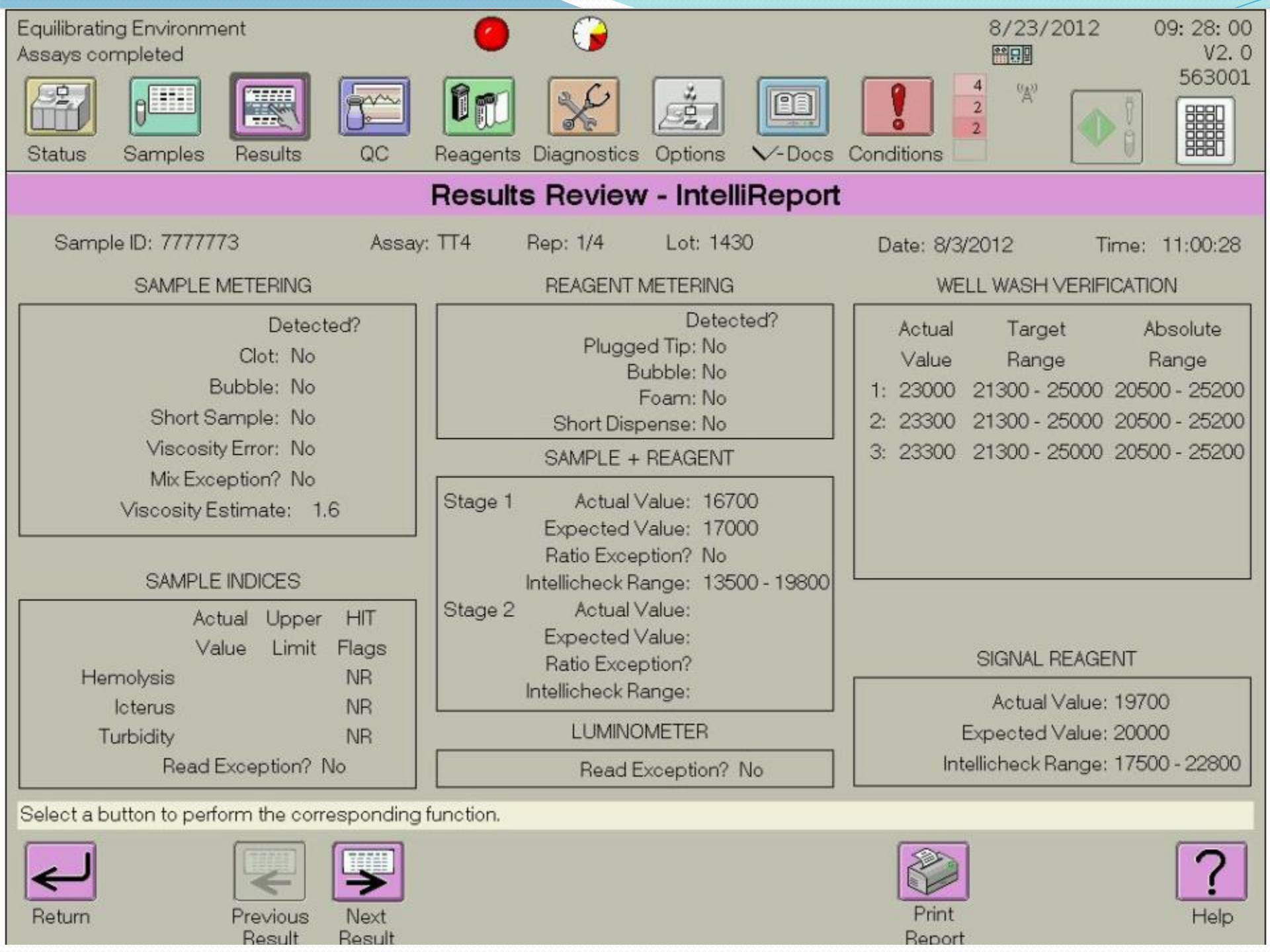
- Self-calibration before measurement

Well Wash Probe Assembly



Journey of the Well

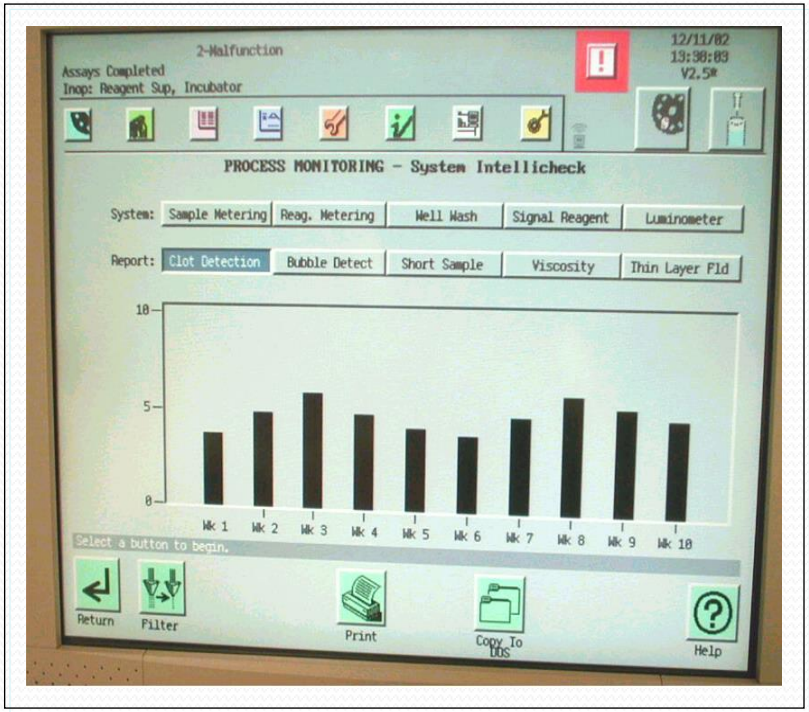



Equilibrating Environment
Assays completed
8/23/2012
09: 28: 00
V2. 0
563001
Status
Samples
Results
QC
Reagents
Diagnostics
Options
Docs
Conditions
Results Review - IntelliReport
Sample ID: 7777773
Assay: TT4
Rep: 1/4
Lot: 1430
Date: 8/3/2012
Time: 11:00:28
SAMPLE METERING
Detected?
Clot: No
Bubble: No
Short Sample: No
Viscosity Error: No
Mix Exception? No
Viscosity Estimate: 1.6
SAMPLE INDICES
Actual Value
Upper Limit
HIT Flags
Hemolysis NR
Icterus NR
Turbidity NR
Read Exception? No
REAGENT METERING
Detected?
Plugged Tip: No
Bubble: No
Foam: No
Short Dispense: No
SAMPLE + REAGENT
Stage 1
Actual Value: 16700
Expected Value: 17000
Ratio Exception? No
Intellicheck Range: 13500 - 19800
Stage 2
Actual Value:
Expected Value:
Ratio Exception?
Intellicheck Range:
LUMINOMETER
Read Exception? No
WELL WASH VERIFICATION
Actual Value
Target Range
Absolute Range
1: 23000 21300 - 25000 20500 - 25200
2: 23300 21300 - 25000 20500 - 25200
3: 23300 21300 - 25000 20500 - 25200
SIGNAL REAGENT
Actual Value: 19700
Expected Value: 20000
Intellicheck Range: 17500 - 22800
Select a button to perform the corresponding function.
Return
Previous Result
Next Result
Print Report
Help

Intellicheck™ Technology

Traceability

- Intellicheck Monitoring
  - Displays subsystem Intellicheck Technology verifications performed throughout sample and assay processing
    - On-screen and print reports
    - Exception detection indication



integrity by intellicheck™

Increased Analyzer Intelligence - Can it Reduce Error?

- Study assessed
  - Intelligent, automated pre-analytical process control abilities
    - Newer generation analyzers compared to older analyzers (VITROS ECi, Elecsys 2010, Axsym)
    - Impact to error reduction
- Defined errors as a reported result exceeding 3SD from the mean of the analyte of the individual analyzer

Increased Analyzer Intelligence – Can it Reduce Error, Albert W. Jekelis, Ph.D., University of Medicine and Dentistry of New Jersey - University Behavioral HealthCare

Results

- **Intelligent error detection improves process:**
  - Reduces misreported results
  - May reduce repeats
  - May reduce operator intervention
  - May reduce reagent waste

Increased Analyzer Intelligence – Can it Reduce Error, Albert W. Jekelis, Ph.D., University of Medicine and Dentistry of New Jersey - University Behavioral HealthCare

High Quality—Intellicheck® Technology

- Proprietary technology provides unique results integrity

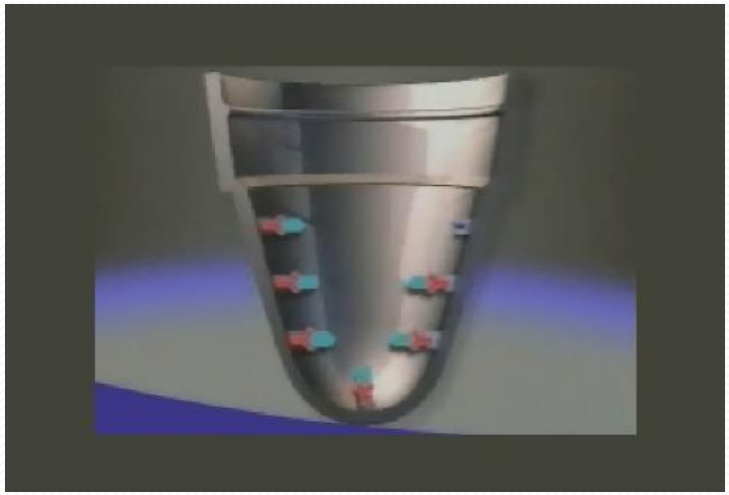
integrity by intelli check

- Designed to significantly reduce analytical errors
  - SMART Metering™
  - MicroSensor™
  - IntelliReport™
- Integrated Process Control
- Traceability with real-time documentation for exceptions
- Prevents reporting of results that may be affected by exceptions

Analytical control process for each test

High Quality—Assay Performance[1]

- MicroWell™ Technology
  - Enables excellent assay sensitivity and precision
  - Allows small sample volumes
  - Small MicroWell™ size minimizes waste



- Proprietary Enhanced Chemiluminescence Detection Technology**
  - Improved signal (light) output
  - Excellent sensitivity and precision
  - Broad dynamic range

***Compared to direct and other indirect chemiluminescence methods*

Proven VITROS® technology that provides high quality results in diverse patient settings

** Summers M et al. Luminogenic Reagent Using 3-Chloro 4-Hydroxy Acetanilide to Enhance Perioxidase/Luminol Chemiluminescence.*Clinical Chemistry*; 41.S73;1995

** Thorpe, Gary H.G.; Kricka, Larry J.; Moseley, Susan B.; Whitehead, Thomas P.; Phenols as Enhancers of the Chemiluminescent Horseradish Peroxidase-Luminol-Hydrogen Peroxide Reaction: Application in Luminescence-Monitored Enzyme Immunoassays; *Clinical Chemistry;* 31:8, 1985

[1] Based on VITROS® ECiQ Immunodiagnostic System

VITROS *System with Intellicheck*™

Broad Menu Range at the touch of a button

Thyroid
- TSH
- FT4
- FT3
- TT4
- TT3
- T3U
- iPTH

REP Endo
- E2
- LH
- FSH
- Prolactin
- Progesterone
- Total Beta HCG
- Testesterone

Oncology
- CA 125
- CA 15-3
- CA 19-9
- CEA
- AFP
- PSA
- B hCG II

Infectious Disease
- HBsAgES
- HBsAg Conf
- Anti-HBs
- Anti-HCV
- Anti-HIV 1+2
- Anti-HAV IgM
- Anti-HAV Total
- Anti-HBc IgM
- HBeAg
- Anti-HBe
- Anti-HBc
- HCV Ag*
- Toxo IgM
- Toxo IgG
- Rubella IgM
- Rubella IgG
- Anti HIV Combo*
- CMV IgG
- CMV IgM
- Syphilis

Anaemia
- Ferritin
- B12
- Folate
- Red Cell Folate

Cardiology
- CK-MB
- Troponin I
- Trop I ES
- Myoglobin
- Pro NT BNP

Bone
- NTx

Metabolism
- Cortisol
- Vitamin D

VELAMMAL MEDICAL COLLEGE
HOSPITAL AND RESEARCH INSTITUTE
MADURAI - 625009

Department of Biochemistry

Report on Certificate course on ELISA Technique

Topic: ELISA Technique

Date: 26.02.2020

Venue: Biochemistry Demonstration Room

Target Audience: First year M.B.B.S., students

Number of Participants: 142

Event Report: The event started with the welcome address by Dr. P.K. Mohanty. Following that Dr.K.Suganthy started the lecture on ELISA. She explained the different types of ELISA with their principle and methods. She demonstrated the procedure for estimation of ANA by ELISA.

Outcome: Participants should know the different types of ELISA their principle and method and how to handle the ELISA instrument.

Prof. T. THIRUNAVUKKARASU, M.D.,D.A.,
Dean
Velammal Medical College Hospital
and Research Institute
"Velammal Village"
Madurai-Tuticorin Ring Road
Anuppanadi, Madurai-625 009, T.N.

VELAMMAL MEDICAL COLLEGE
HOSPITAL AND RESEARCH INSTITUTE
MADURAI - 625009

VELAMMAL MEDICAL COLLEGE
HOSPITAL AND RESEARCH INSTITUTE
MADURAI - 625009

Velammal Medical College Hospital and Research Institute

Ref. No: VMCHRI/BIOCHEM/CC-6 Date: 03.03.2020

CIRCULAR

To

All Doctors

Certificate Course on DNA extraction and PCR

Department of Biochemistry is organizing a certificate course on DNA extraction and PCR on 16.03.2020 (Monday) between at 9.00 AM to 3.00 PM.

All Faculties are invited.

VICE PRINCIPAL

Dr. P.K. MOHANTY
Vice Principal
Velammal Medical College Hospital
and Research Institute
Madurai-625 009

Copy submitted to:

The Hon. Chairman

Copy to:

The Dean

Medical Superintendent

Chief Administration Officer

HOD, Biochemistry

All Clinical and Non-Clinical HODs

Velammal Medical College Hospital & Research Institute

Anuppanadi, Madurai - 625009

Department of Biochemistry

Certificate course on

DNA extraction and PCR

Venue: Biochemistry Demonstration Room

Date: 16.03.2020

For First year M.B.B.S., students

PATRON

Chairman: Shri.M.V.Muthuramalingam

Advisors:

Dean: Dr.R.M. Raja Muthaiah

MS: Dr. Somasundarm

DR.A.Hariharan
Course coordinator
Biochemistry

DR.P.K.Mohanty
Vice Principal
Prof. HOD Biochemistry

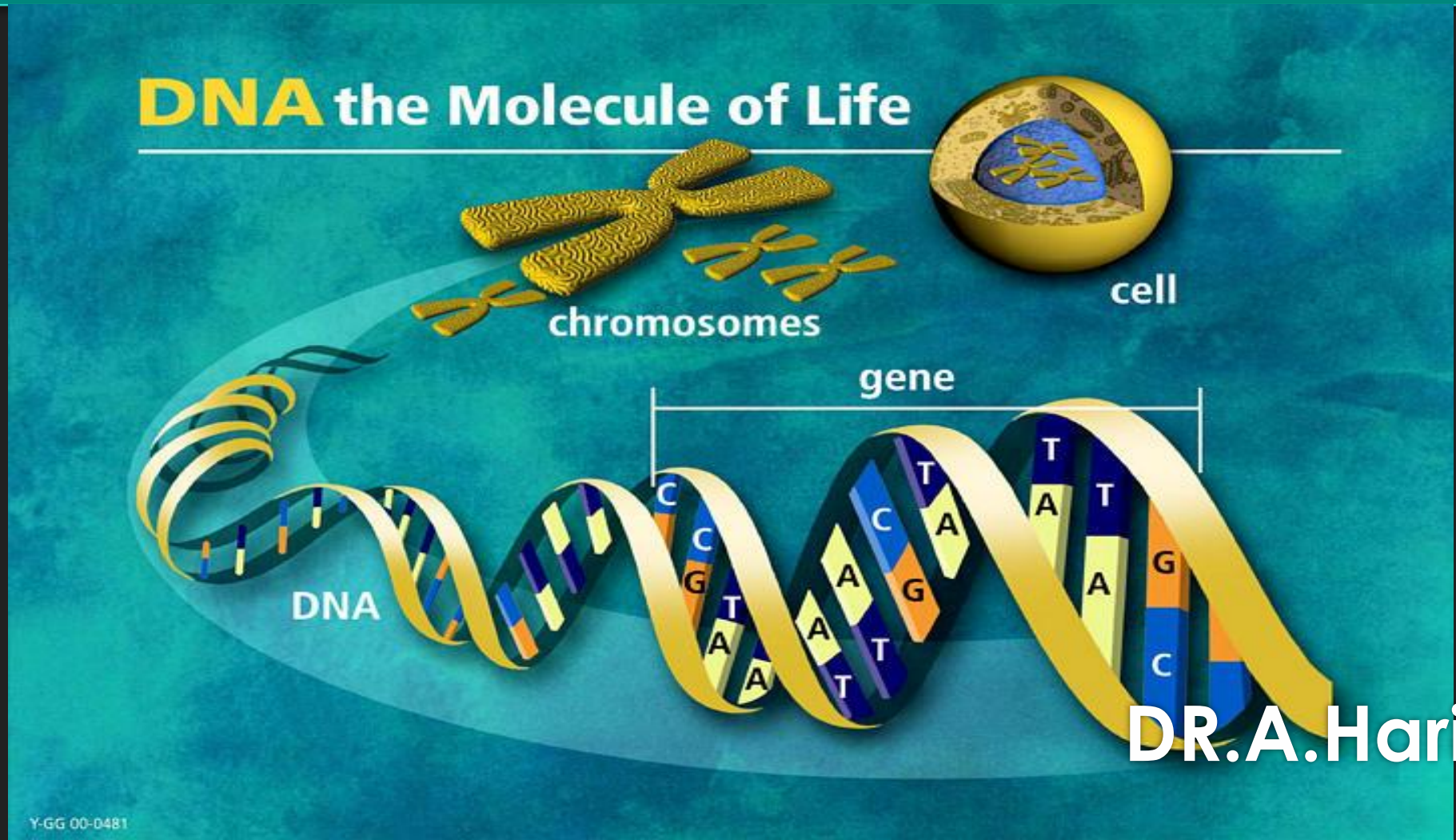
Objective: Should be able to do DNA extraction and amplification with PCR

Teaching Method: Lecture and demonstration

Agenda

Time	Topics	Speaker
09.00 – 09.15 AM	Welcome address	DR.P.K.Mohanty
09.15 – 9.30 AM	Pre test	DR.A.Hariharan
9.30 – 10.30 AM	Nucleic acid chemistry – Basics	DR.A.Hariharan
10.30 – 11.30 AM	DNA extraction and Quantification	DR.A.Hariharan
11.30 AM– 1.00 PM	Traditional PCR	DR.A.Hariharan
1.00 – 2.00 PM	LUNCH	
2.00 – 2.30 PM	Post test and feedback	DR.A.Hariharan
2.30 – 3.00 PM	Feed back and Valediction	DR.P.K.Mohanty

Certificate course
Nucleic Acid Chemistry – Basics
DNA Extraction and Quantification

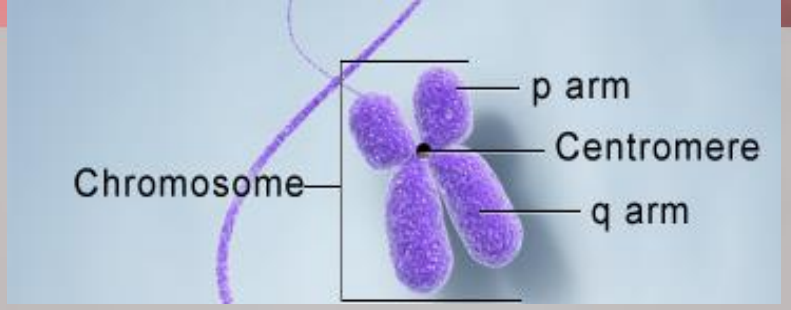


DR.A.Hariharan

Objectives

- Basics – Nucleotides, Polynucleotides
- Structure of DNA – Watson & Crick
- DNA Extractionby Miller etal Method – Demonstration
- Quantification- Spectrophotometric method

DNA -Introduction



- **Chromosomes** are made of both DNA, it is the genetic code.(Genetic Resoitory)
- It determines our physical characteristics,Our DNA codes for 20 amino acids which building blocks of life
- Chemical energy to cells
- Components of enzyme cofactors
- Regulatory molecules – Second messengers

  cAMP, cGMP

Timeline

1800's	F Miescher - nucleic acids
1928	F. Griffith - Transforming principle
1944	Avery, McCleod & McCarty- Transforming principle is DNA
1949	Erwin Chargaff – base ratios
1952	Hershey-Chase 'blender' experiment
1952	R Franklin & M Wilkins–DNA diffraction pattern

http://www.dnai.org/lesson/go/2166/1994

The Watson-Crick Model: DNA is a double helix

WE wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.). This structure has novel features which are of considerable biological interest. *Watson and Crick, 1953, Nature, 171*

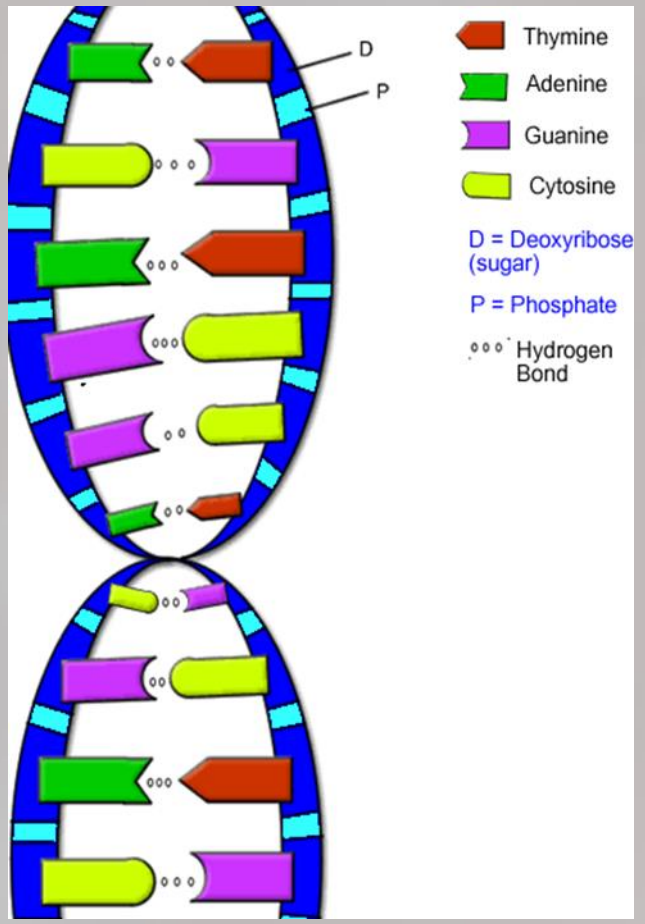
- In 1951 Watson learns about x-ray diffraction pattern projected by DNA
- Erwin Chargaff's experiments demonstrate that ratio of A and T are 1:1, and G and C are 1:1
- Chemical structure of nucleotides were known (deoxyribose sugar, phosphate, and nitrogenous base)
- Putting this together……

….in 1953 James Watson and Francis Crick propose their double helix model of DNA structure

STRUCTURE OF DNA

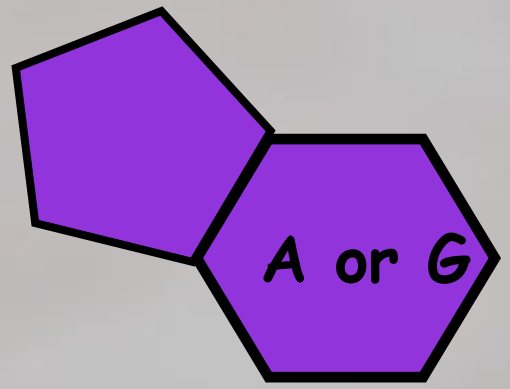
- Right handed Double helix stranded
- Each strand of DNA is a long, unbranched, linear polymer of nucleotides.
- → Polynucleotides

  → Phosphodiester bond

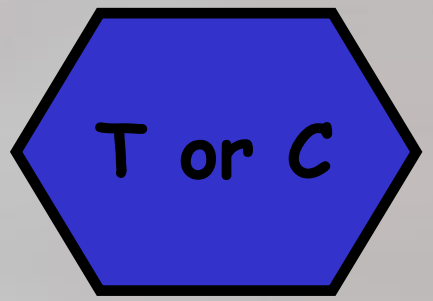


Nitrogenous Bases

- Double ring **PURINES**
  - Adenine (A)
  - Guanine (G)



- Single ring **PYRIMIDINES**
  - Thymine (T)
  - Cytosine (C)



nucleotide = phosphate ester monomer of pentose

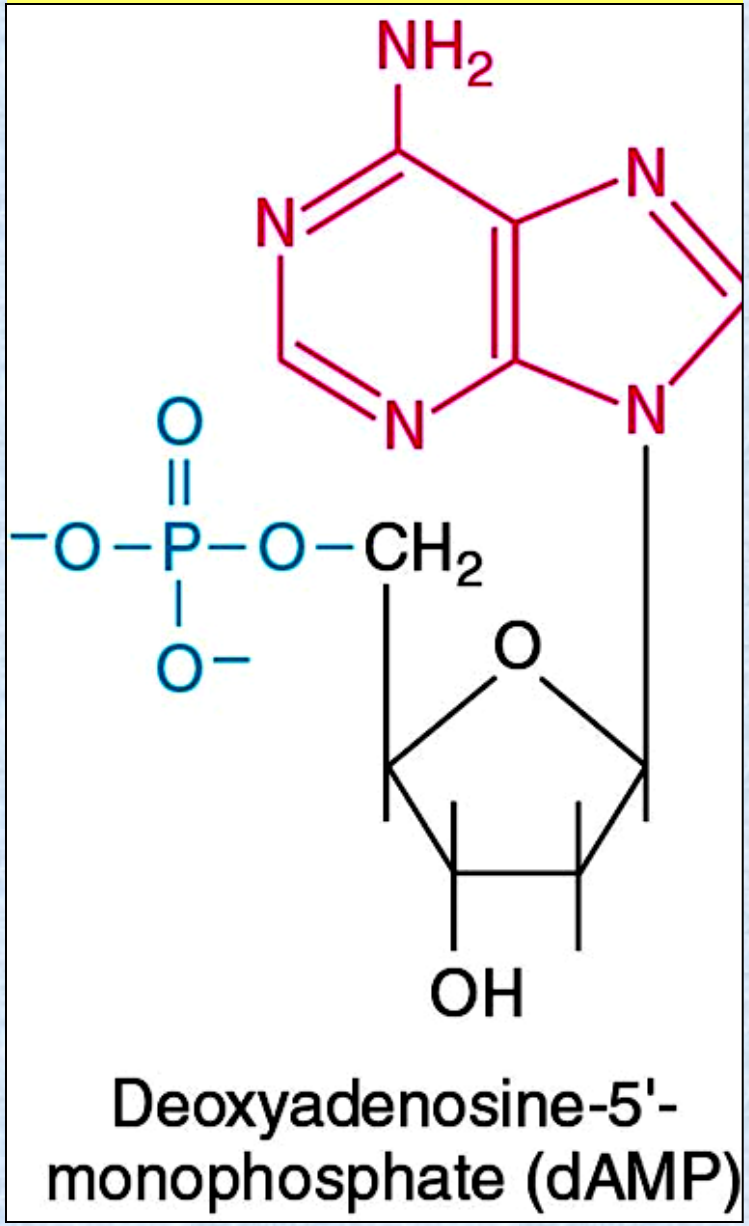
dinucleotide - Dimer

Oligonucleotide – short polymer (<10)

Polynucleotide – long polymer (>10)

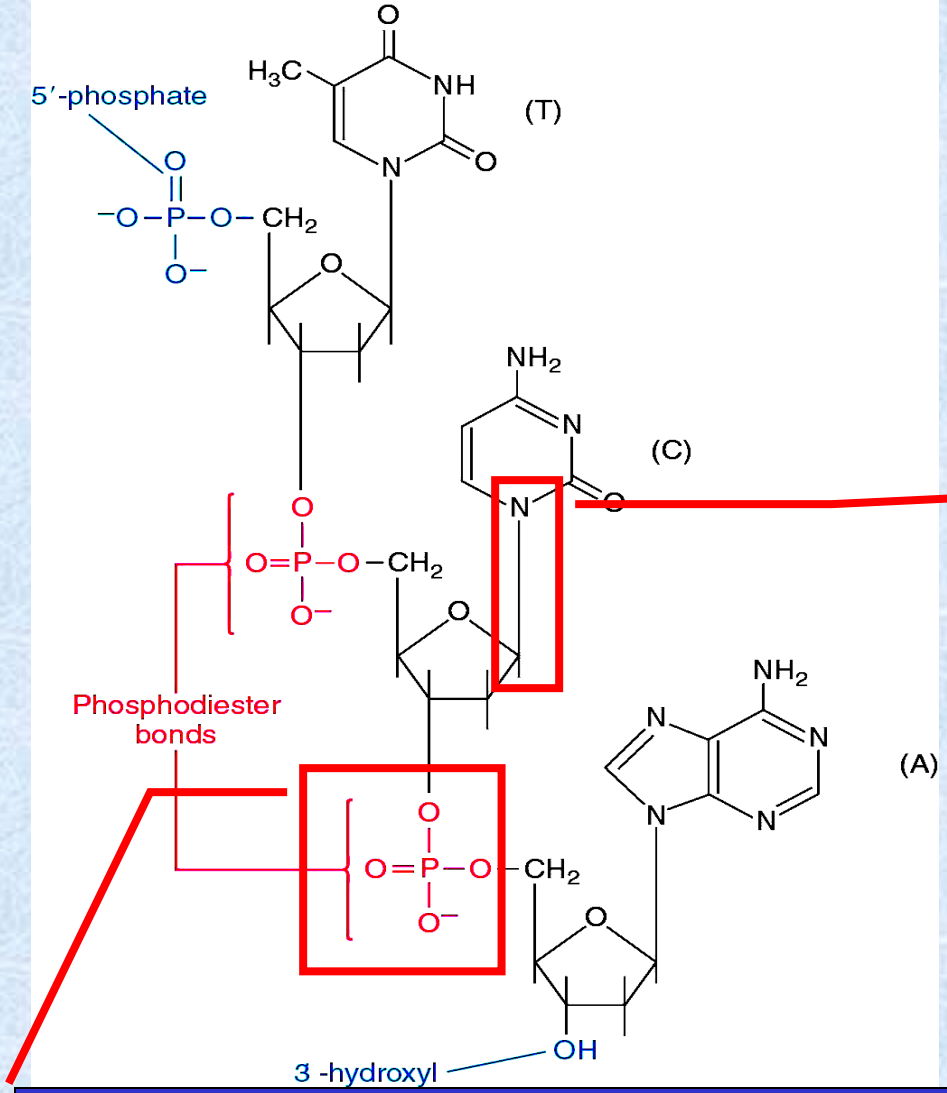
Nucleoside = monomer of sugar + base

Nucleotide monomer



Deoxyadenosine-5'-monophosphate (dAMP)

5' – 3' polynucleotide *linkages*



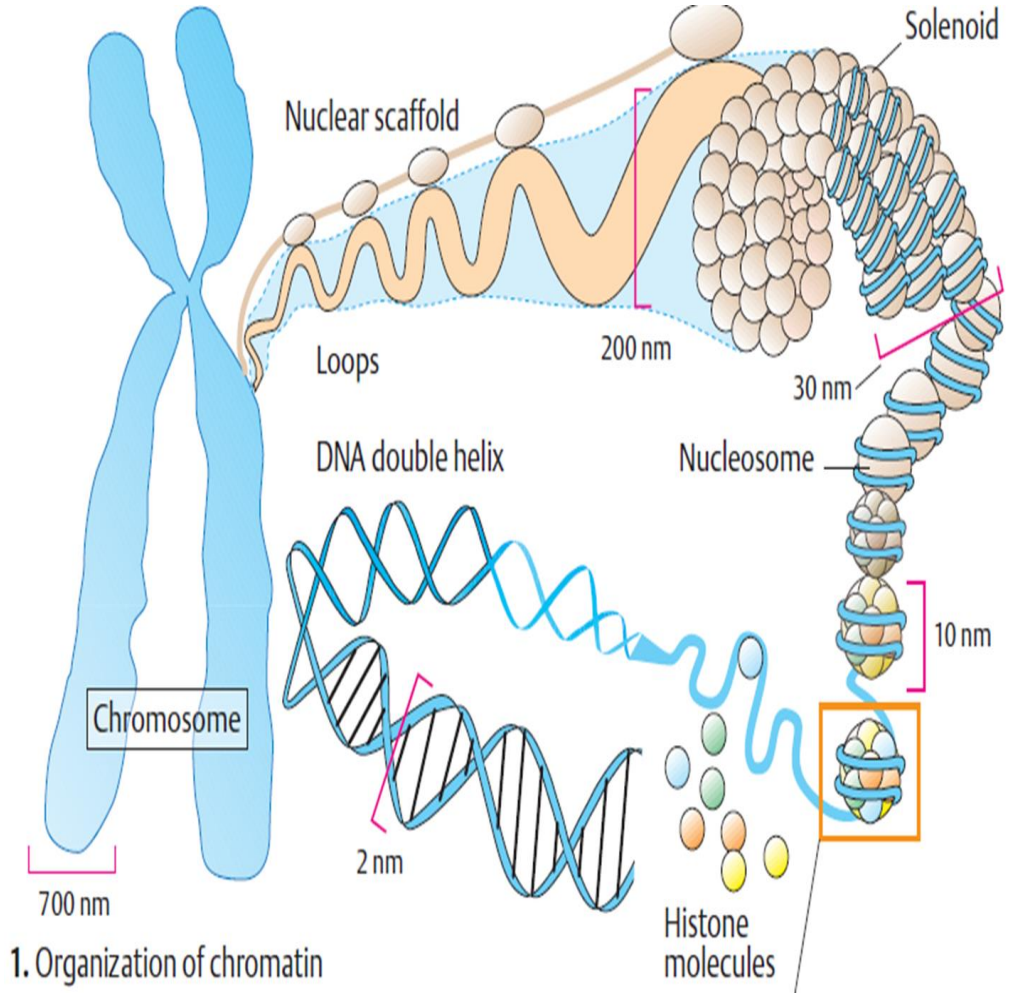
2) N-glycosidic bonds

Links nitrogenous base to C1' pentose in beta configuration

1) Phosphodiester bonds

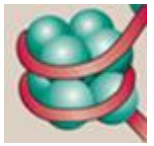
5' and 3' links to pentose sugar

Structural Organization of chromosome



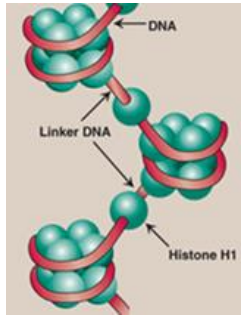
1. Organization of chromatin

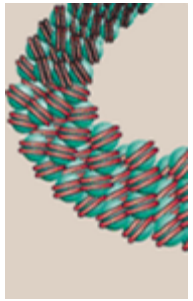
dsDNA



Nucleosome

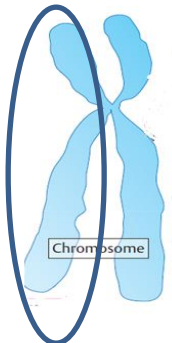
Polynucleosomes





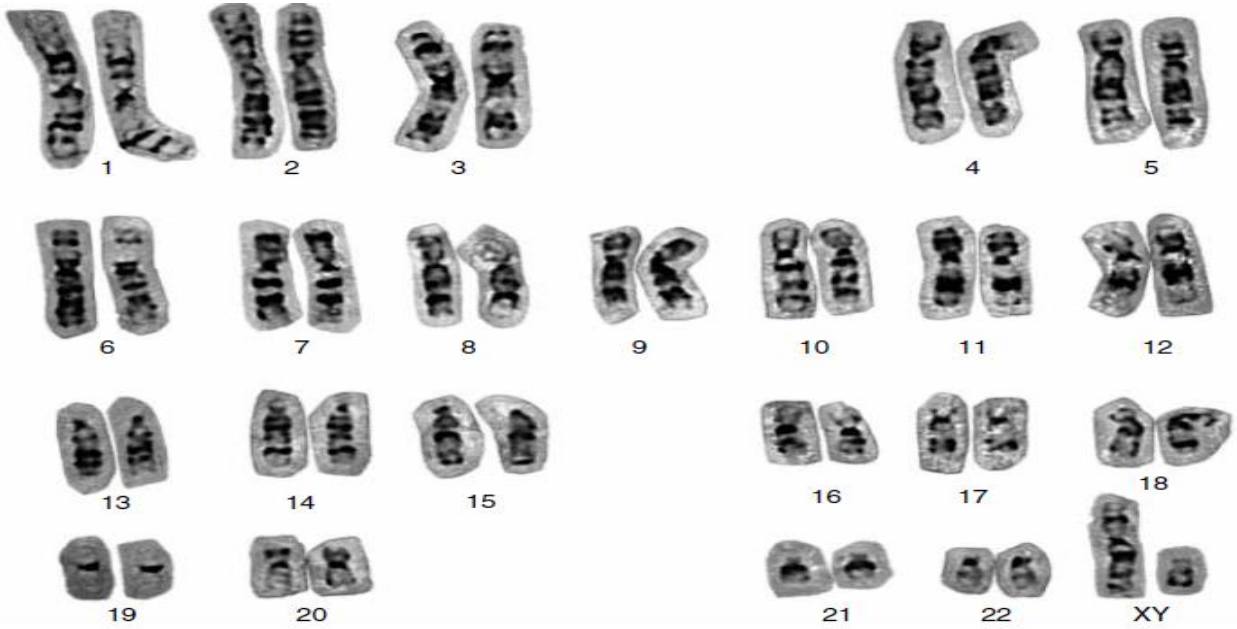
Chromatin

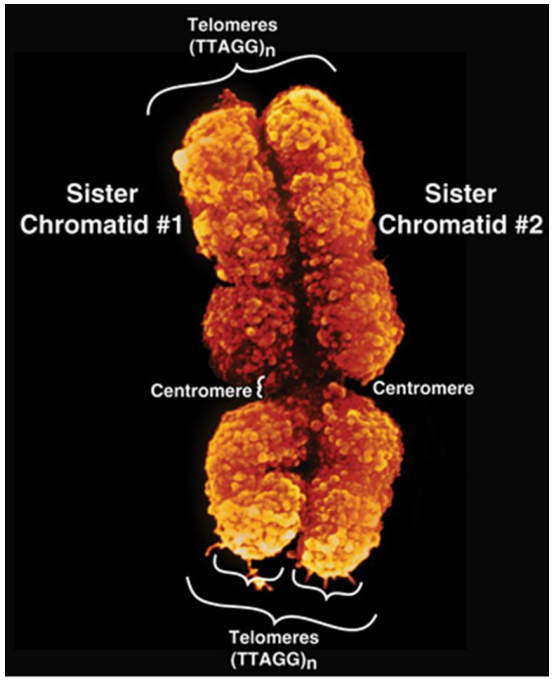
Sister Chromatid



Genome : The whole genetic material (i.e the total no of chromosomes) in a cell

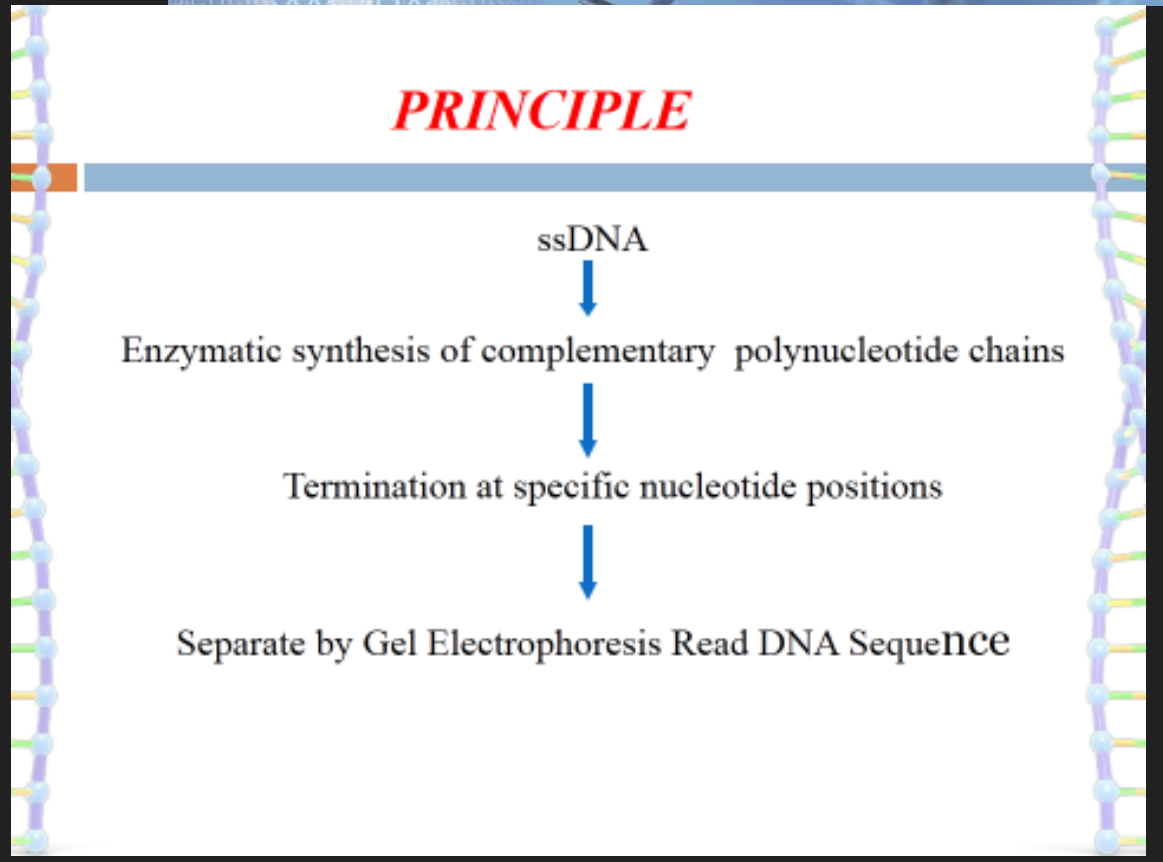
Human Genome contains: 23 pairs (46 nos) in which Somatic 22 pairs, plus XY in male, XX in female.



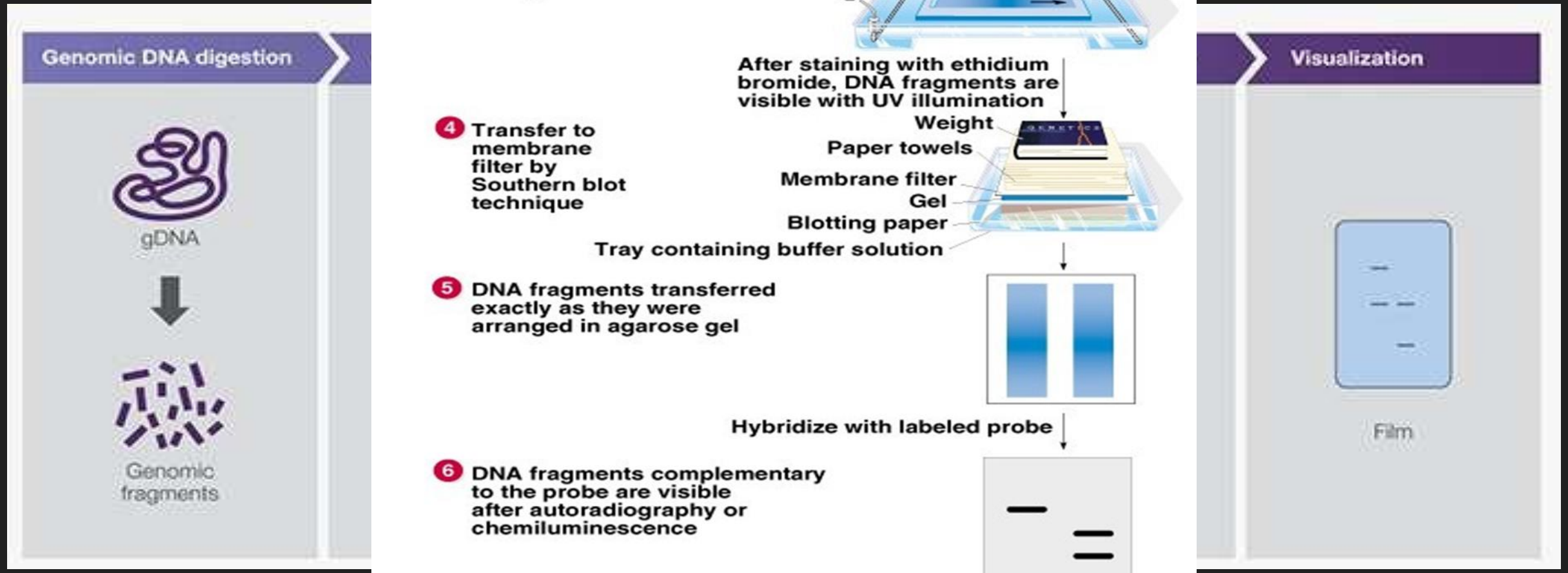


DNA Sequencing- Applications

- Determining the precise order of nucleotides within a DNA molecule.
- Used to determine the sequence of individual genes, larger genetic regions, full chromosomes or entire genomes.
- Forensics:
- To identify individuals because each individual has a different genetic sequence
- Medicine:
- To detect the genes which are linked to various genetic disorders such as muscular dystrophy.
- Agriculture:
- The mapping and sequencing of a genome of microorganisms has helped to make them useful for crops and food plants



RFLP - Restriction
The patterns gene es (and even strains) from



1. Cellular DNA

Cut with restriction enzyme

2. Restriction fragments of lengths determined by location of recognition sequences for restriction enzyme

Agarose gel

3. Gel electrophoresis of fragments

After staining with ethidium bromide, DNA fragments are visible with UV illumination

4. Transfer to membrane filter by Southern blot technique

Weight
Paper towels
Membrane filter
Gel
Blotting paper
Tray containing buffer solution

5. DNA fragments transferred exactly as they were arranged in agarose gel

Hybridize with labeled probe

6. DNA fragments complementary to the probe are visible after autoradiography or chemiluminescence

DNA Library

cDNA libraries

cDNA libraries are very useful for eukaryotic gene analysis

- **Condensed protein encoded gene libraries, have much less junk sequences.**
- **cDNAs have no introns → genes can be expressed in *E. coli* directly.**
- **Are very useful to identify new genes**
- **Tissue or cell type specific** (differential expression of genes)

Application of cDNA library:-

- Discovery of novel genes.
- Elucidation of gene function.
- In vitro study of gene function.
- To obtain pure sample of a gene.
- To get high yields of recombinant Cdna.
- Commercial production of proteins and other biological molecules.
- Study the alternative splicing.
- Carcinogen identification.

DNA Extraction and Quantification

MillerSA, Dykes DD,PoleskyHF.A simple salting out procedure for extracting DNA from human nucleated cells. NucleicAcidsRes.1988Feb11;16(3):1215.

http://www.whatisbiotechnology.org/science/extractio

Biological materials used for DNA profiling

- Blood
- Hair
- Saliva
- Semen
- Body tissue cells
- DNA samples have been obtained from vaginal cells transferred to the outside of a condom during sexual intercourse.

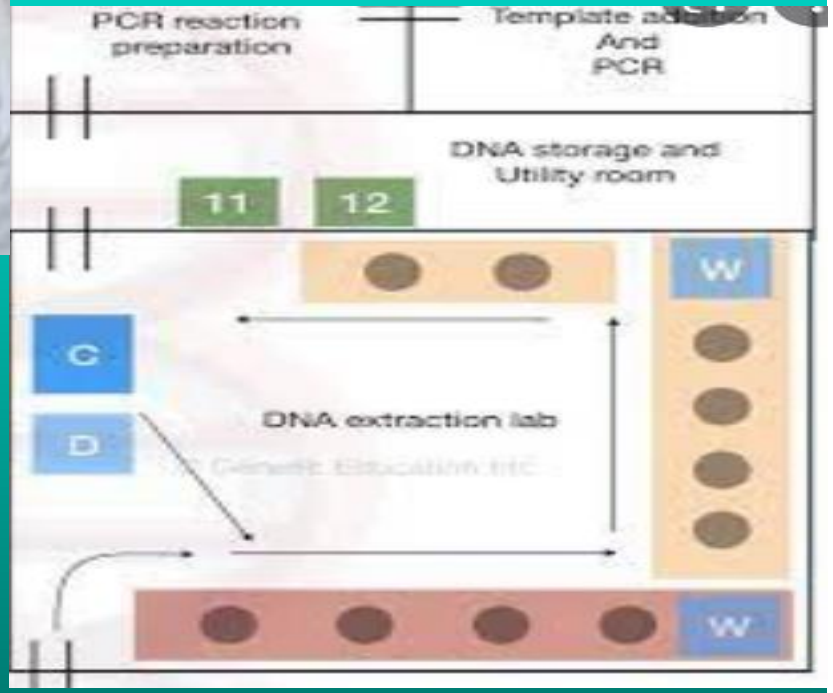
Millers Method – Whole Blood (3-5ml)

PRINCIPLE

- Removal and separation of DNA.

1. Cell Lysis
2. Precipitation
3. Wash
4. Resuspension

- Remove the non- Cellular component (Plasma)
- RBC Lysis Buffer – Salts to Rupture of RBC
- WBC Lysis Buffer- Salts to Rupture WBC (Nucleated Pellet)
- SDS/ Proteinase K- interfere restriction endonuclease
- Precipitation DNA -Subsquent extraction with chloroform, Ethanol mixture
- Stir at 4 degee Celsius



Reagents Requirement

10% Disodium EDTA salt. (For blood collection):

10gm in 100ml of MilliQ Water. Autoclave and store at room temperature.

Hypotonic buffer:

Ammonium chloride - 7.0 g

Ammonium bicarbonate - 0.072g

Dissolve in about 800 ml of MilliQ water and make up to 1 litre. Autoclave and store at room temp.

WBC lysis solution:

Na_2EDTA 10ml - 1.8g in 10ml of MilliQ water (0.5 M)

NaCl - 0.876g

Dissolve in 160ml of MilliQ water; adjust the pH to 8.0 using NaOH and make up to 200ml. Autoclave and store at room temp.

Proteinase K (10mg/ml):

Dissolve 100mg of Proteinase K in 10ml of MilliQ water. Aliquot 500ml in micro centrifuge tubes and store at –20 ^{o} C.

10 % Sodium dodecyl sulphate (SDS):

10g of SDS in 80ml of MilliQ water and make up the final volume to 100ml.

Saturated NaCl :

Normally 1gm of Nacl dissolves in 2.8ml of MilliQ water at 25^{o} C. Dissolve 1.1gm in 2.8ml of MilliQ water will give saturated NaCl.

Chloroform:Octanol (24:1):

Mix 24ml of Chloroform with 1ml of Octanol.

1 X Tris EDTA buffer (pH 7.4)

10 mMTris - 1.20 g }

Quantification

Formula for calculating concentration of DNA from OD values

OD value X Diluting factor X 50 = Concentration of DNA in µg/ml or ng/µl

(1 in 100 dilution done in above example; dilution factor is 100)

Formulas:

1.0 A260 unit double stranded DNA= 50µg/ml= 0.15µM(in nucleotides)

1.0 A260 unit single stranded DNA= 33µg/ml = 0.10µM(in nucleotides)

1.0 A260 unit single stranded RNA= 40µg/ml = 0.11µM(in nucleotides)

Conversions for ds DNA

(Data at hand in pmol) (Required data in µg)

No. of pmol X N X 660 X 10^{-6} = No. of micrograms

(Data at hand in µg) (Required data in pmol)

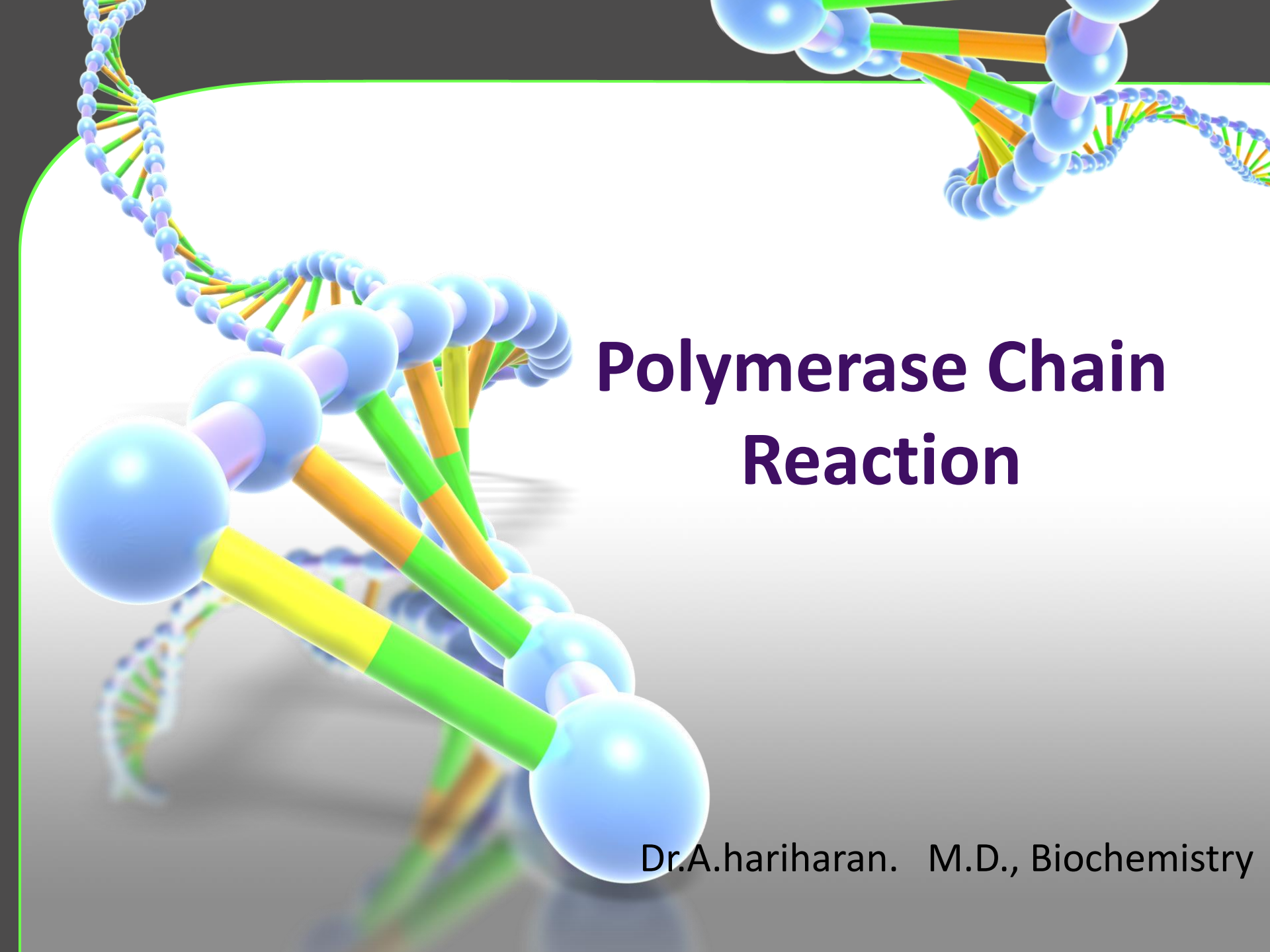
No. of micrograms X 1/N X 1/660 X 10^{-6} = No. of picomoles(pmoles)

Where N is number of base pairs and 660 is the average mol. Wt.

DNA Extraction and Quantification

MillerSA, Dykes DD,PoleskyHF.A simple salting out procedure for extracting DNA from human nucleated cells. NucleicAcidsRes.1988Feb11;16(3):1215.

http://www.whatisbiotechnology.org/science/extractio



Polymerase Chain Reaction

Dr.A.hariharan. M.D., Biochemistry

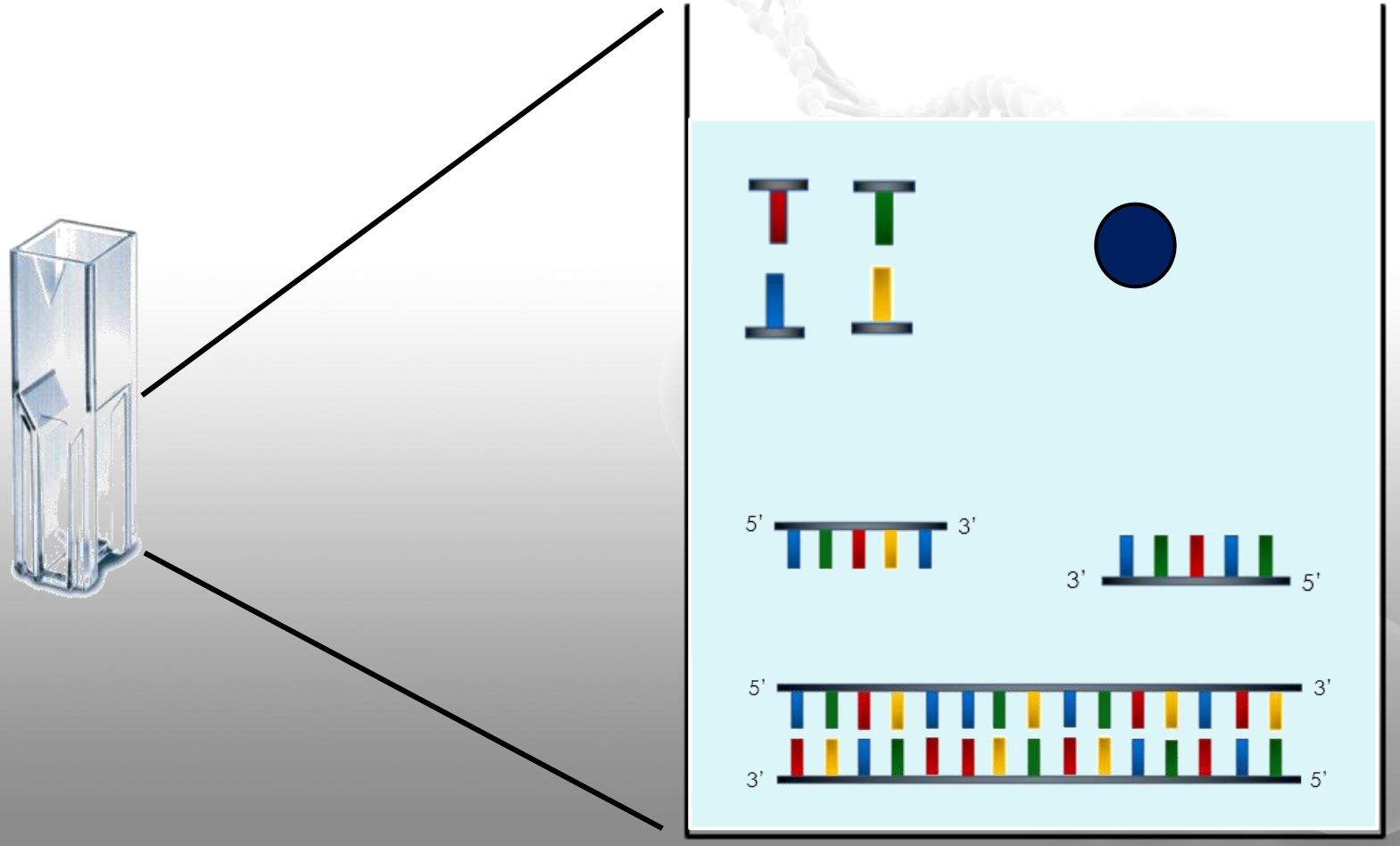
Introduction

- PCR is an in vitro method of amplifying a target sequence of DNA .

- Steps in PCR:

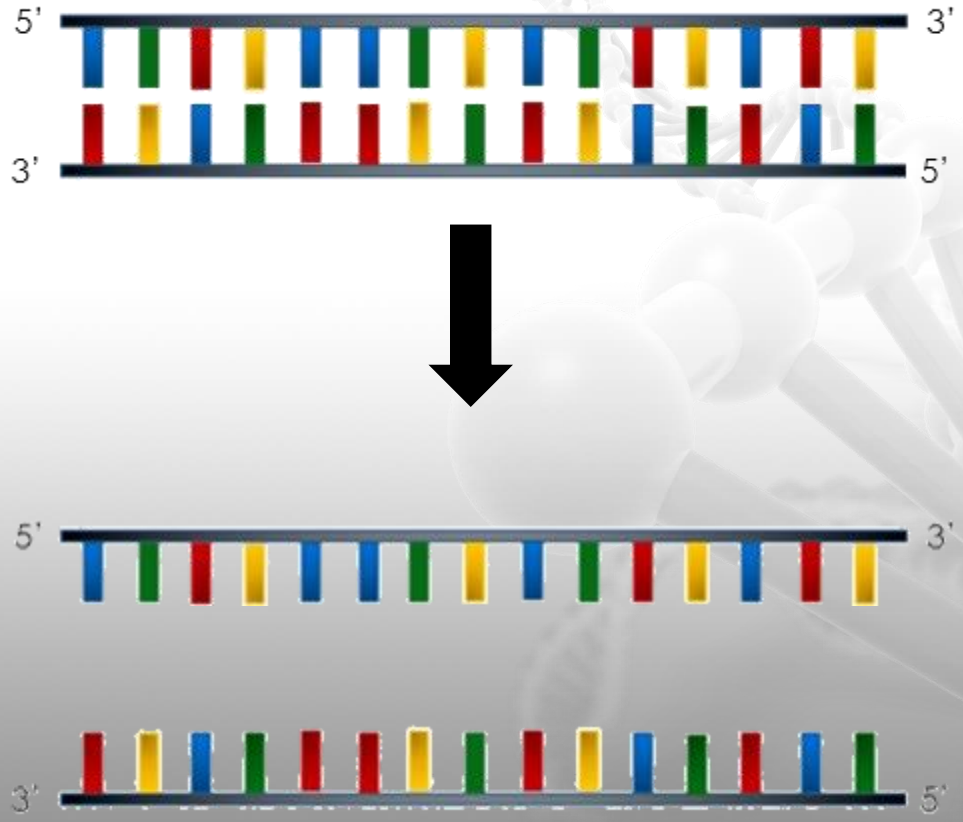
    1. Denaturation.
    2. Annealing.
    3. Extension.

Substance need for PCR



Thermocycler

Denaturation

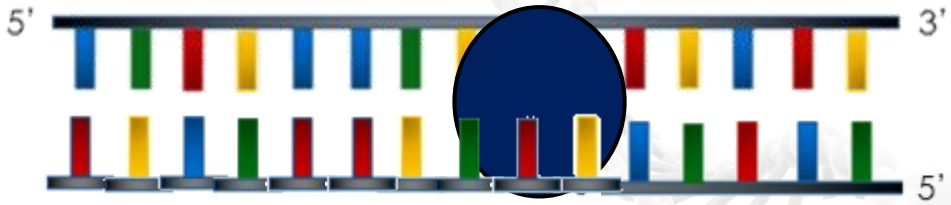


94* C

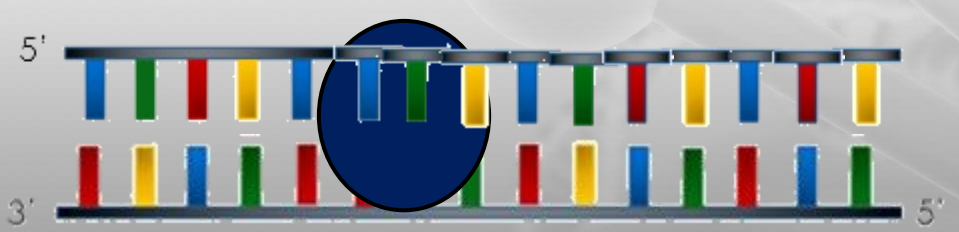
Annealing

55* C

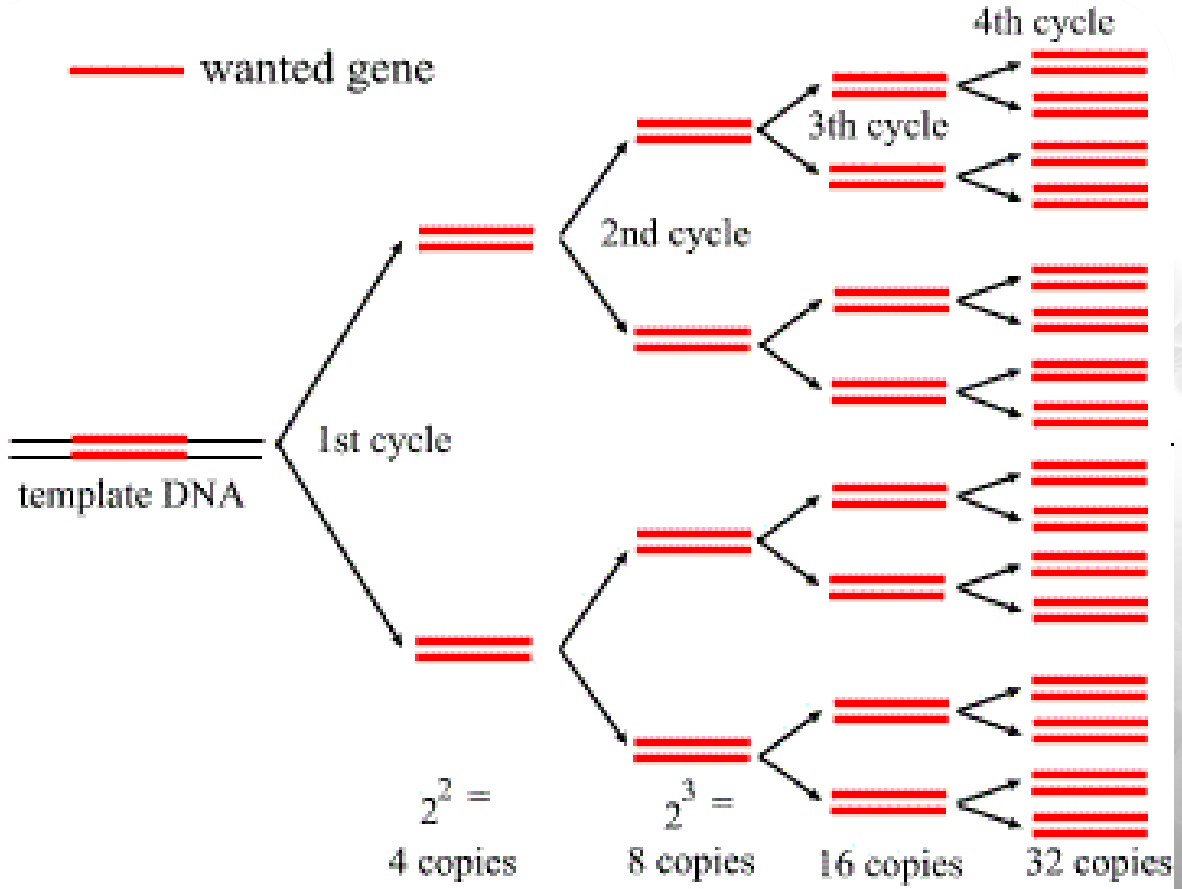
Extension



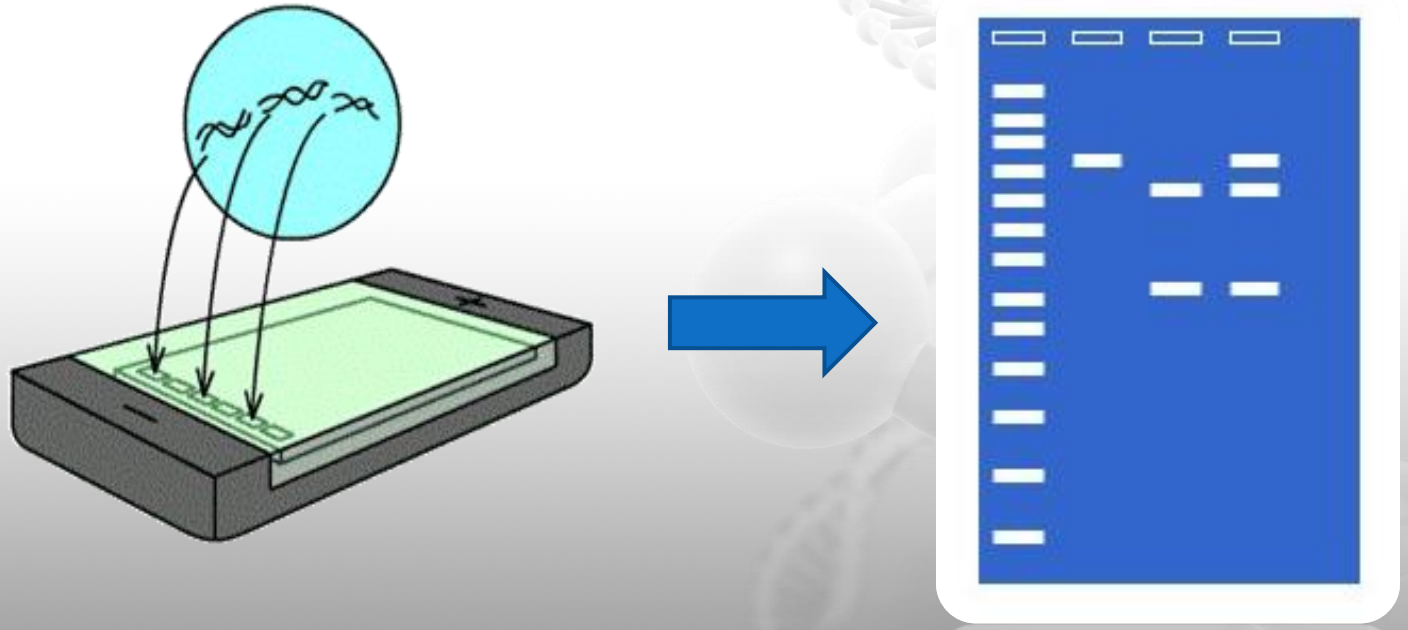
72* C



Amplification



Isolation and identification of fragment of interest



Applications

1. Diagnosis of bacterial and viral diseases.
2. To make prenatal genetic diagnosis.
3. To establish precise tissue type for transplants.
4. Diagnosis of genetic disorders.
5. In cancer detection.
6. To study evolution using DNA archeological samples.

VELAMMAL MEDICAL COLLEGE
HOSPITAL AND RESEARCH INSTITUTE
MADURAI - 625009

Department of Biochemistry

Report on Certificate course on DNA extraction and PCR

Topic: DNA extraction and PCR

Date: 16.03.2020

Venue: Biochemistry Demonstration Room

Target audience: First year M.B.B.S., students

Number of participants: 132

Event Report: The event started with the welcome address by Dr. P.K. Mohanty. Following that Dr.A.Hariharan started the lecture on Basic about nucleic acid chemistry and steps in DNA extraction. Then he demonstrated the DNA extraction. He explained the steps in PCR, primer designing and demonstrated the procedure in polymerised chain reaction.

Outcome: Participants should be able to do the DNA extraction and amplification of DNA by PCR.

Prof. T. THIRUNAVUKKARASU, M.D.,D.A.,
Dean
Velammal Medical College Hospital
and Research Institute
"Velammal Village"
Madurai-Tuticorin Ring Road
Anuppanadi, Madurai-625 009, T.N.

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MADURAI - 625009

VELAMMAL MEDICAL COLLEGE
HOSPITAL AND RESEARCH INSTITUTE
MADURAI - 625009

From

Dr. V. Raviraman
Department of Orthopaedics
Velammal Medical College Hospital and RI
Madurai

To:

The Dean
Velammal Medical College Hospital and RI
Madurai

8/4/2019

Prof. T. THIRUNAVUKKARASU, M.D.,D.A.,
Dean
Velammal Medical College Hospital
and Research Institute
"Velammal Village"
Madurai-Tuticorin Ring Road
Anuppanadi, Madurai, T.N.-625 009

Respected Sir:

We from the department of Orthopedics are planning to conduct a Certificate Courses – **"REHABILITATION OF PARAPLEGIC"** on 08/11/2019 involving Ortho posting M.B.B.S Students & CRRIs. We kindly request you to give permission to conduct the same. Kindly do the needful.

Thanking You

Date: 30.10.2019

Yours sincerely,

Place: Madurai

Dr. V. Raviraman
Head of the Department

VELAMMAL MEDICAL COLLEGE
HOSPITAL AND RESEARCH INSTITUTE
MADURAI - 625009

Department of Orthopaedics

Certificate Course

Topic: Rehabilitation of Paraplegic

Date : 08/11/2019,

Time : 11.00 am to 01.00 pm

Venue : Ortho Opd Demo Hall

Participant's List

Sl.No	Faculty Name
1.	Dr. V. Raviraman
2.	Dr. S. Shanmuganathan
3.	Dr. Ganesan G Ram
4.	Dr. K. N. Subramanian
5.	Dr. M. Subbiah
6.	Dr. R. Hari sudhan
7.	Dr. Muthu kumar . S
8.	Dr. S. Lokesh Kumar
9.	Dr. E. Vijaya raja
10.	Dr. M.J. Krishna kumar
11.	Dr. S. Dheepan Kumar
12.	Dr. V Janarthanan
	Prefinal Year Students
1.	Ravi Raghul M
2.	Ritika N
3.	Rohith R
4.	Rosalinpunitha K
5.	Roshan M
6.	Roshiny A K
7.	Sakthi Priya S
8.	Sakthi Priya V R
9.	Sakthi Uma Devi V
10.	Sakthivel P
11.	Salma Sheriff

Prof. T. THIRUNAVUKKARASU, M.D.,D.A.,
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Velammal Medical College Hospital
and Research Institute
"Velammal Village"
Madurai-Tuticorin Ring Road
Anuppanadi, Madurai-625 009, T.N.

12.	Sangeetha R
13.	Sangeetha T
14.	Sanjini Ramesh Babu
15.	Sankar A
16.	Santha Moorthy K
17.	Santhosh M
18.	Santhoshkumar S
19.	Sathiya Prakash V
20.	Senthil Kannan V
21.	Sethuraman N
22.	Sharada Priyadarsini S
23.	Sharanya R
24.	Sharika Sakunthala A
25.	Shivani R

Prof. T. THIRUNAVUKKARASU, M.D.,D.A.,
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VELAMMAL MEDICAL COLLEGE
HOSPITAL AND RESEARCH INSTITUTE
MADURAI - 625009

Department of Orthopaedics

VELAMMAL HOSPITAL
the healing touch

Certificate Course
Title:
Rehabilitation of Paraplegic

AGENDA

TIME	TOPIC	SPEAKER
8.30 am to 09.00 am	Introduction	Dr.K.N. Subramanian
9.00 am to 11.00 am	Positioning	Dr. Sandhosh srinivasan
11.00 am to 01.00 pm	Therapatutic excercises	Dr. Muthu gukan
01.00 pm to 01.30 pm	Lunch	Dr. Ganesan G Ram
01.30 pm to 02.30 pm	Functional ambutation	Dr. R. Hari sudhan
02.30 pm to 03.30 pm	Transporataion & Complications	Dr. E. Vijayaraja
03.30 pm to 04.30 am	Assessment	Dr. S. Lokesh kumar

Date: 08.11.2019

Day: Friday

Venue: Lecture Hall

Duration: 8 hours

Teaching method power point presentation, interactive discussion

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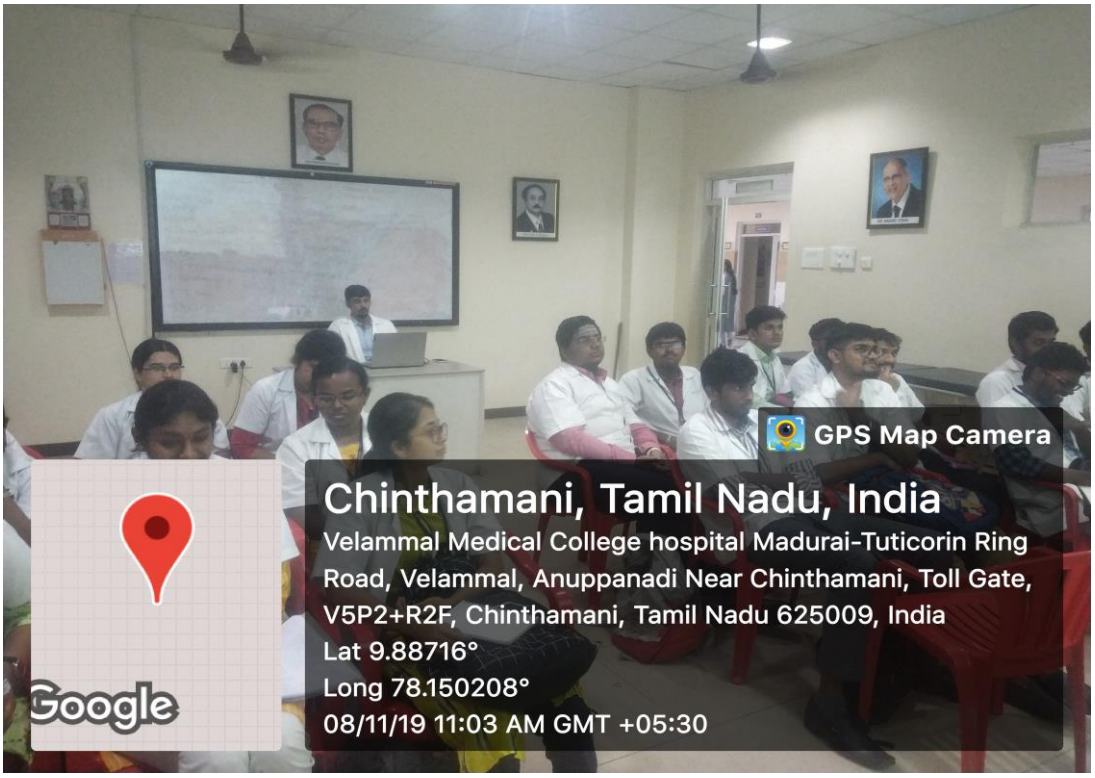
HOSPITAL AND RESEARCH INSTITUTE
MADURAI - 625009



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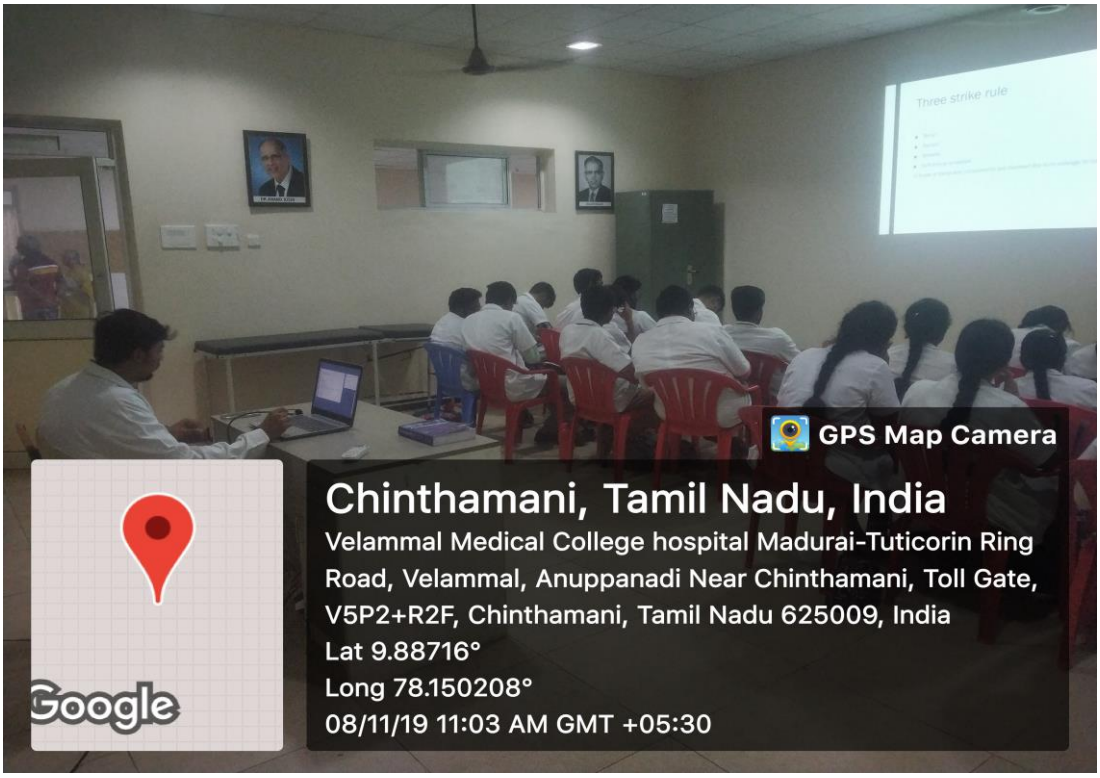
MADURAI - 625009



REHABILITATION OF PARAPLEGIC

DR. MUTHUKUMAR

INTRODUCTION

- Tertiary prevention means disability limitation and rehabilitation. Tertiary prevention begins early in the period of recovery from illness. It consists of such activities as consistent and appropriate administration of medications to optimize therapeutic effects moving and positioning the patient to prevent complications of immobility and active and passive exercises to prevent disability, minimizing residual disability and helping the client learn to live productively with limitations.

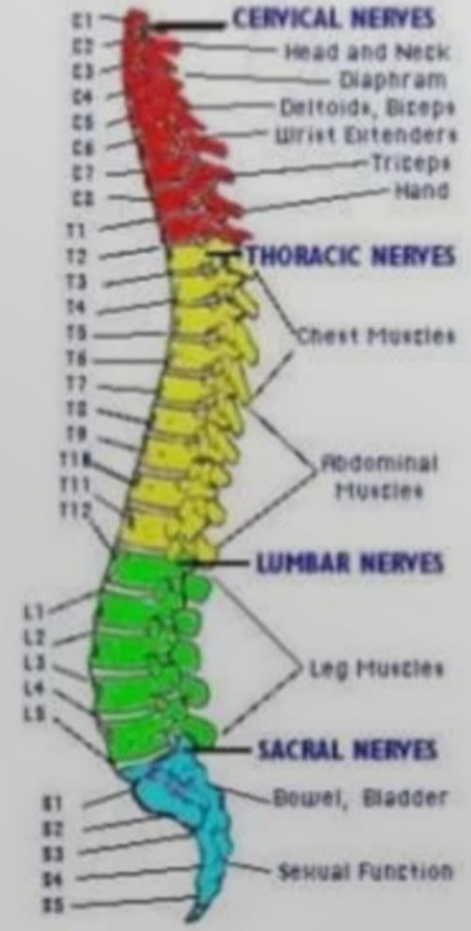
Disease ⟹ Impairment ⟹ Disability ⟹ Handicap

PARAPLEGIA

- Refers to the loss of movement and sensation in both legs and, sometimes, part of lower abdomen.

Paraplegia

Tetraplegia
(Quadriplegia)



REHABILITATION

According to WHO " Rehabilitation is the combined and coordinated use of the medical, social, educational, and vocational measures for training and re-training the individual to the highest possible level of functional ability".

I. General Management

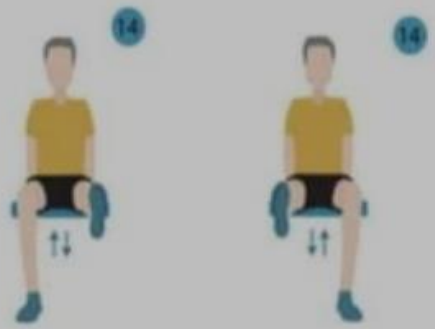
- Frequent change of the patient's posture to guard against bedsores.
- Care of the skin by frequent washing with alcohol followed by talc powder. In case of urinary incontinence, frequent change of bed-sheets.
- Care of the bladder: If there is retention, use parasympathomimetic drugs. If this fails, use a catheter to evacuate the bladder.

Cont.d

- **A balanced exercise program includes three types of exercise:**
- (1) Stretching/Flexibility Exercises
- 2) Aerobic Exercises
- (3) Strengthening Exercises

Aerobic Exercises

- Aerobic exercise strengthens your heart and lungs and improves your body's ability to use oxygen. It also reduces fatigue, increases energy levels and helps you sleep better, control your weight, and lift your spirits.
- It is generally recommended to gradually work up to three or four sessions per week, each lasting 15 to 60 minutes. Include a 5-minute warm-up (including stretching) before the activity and 5 to 10 minutes of a cool down (stretching and slower activity) afterwards. It also includes of
- **Walking**
- **Exercises in the water**
- **Stationary bicycling**
- **Chair exercises**



(3) Strengthening Exercises

- Repeated muscle contractions until the muscle becomes tired.
- Strengthening exercises help increase muscle tone and improve the quality of muscles. This enhances mobility and provides energy and a positive sense of well-being.
- Strong hip and leg muscles are needed to lift the legs to walk, and strong arm muscles are needed to carry out daily functions. Strong abdominal and back muscles help maintain correct posture and can counter pain resulting from poor gait, poor posture or the use of mobility aids.

IV. Orthotics

- Various orthotics are used to assist patient with paraplegia.
- These are: crutch, walker, cane, brace and wheelchair.

V. Gait training

- It is the important part of rehabilitation program balance can be achieved by proper gait training. Gait training can be done by following methods:
- **Pre ambulation MAT program:**
- Rolling, prone on elbow, prone on hand, quadruped, pelvic tilting, setting and standing balance.
- **Parallel bar progression**
- **Advanced parallel bar activities.**
- **Assistive device:** E.g, Cane, crutches, walker

VELAMMAL MEDICAL COLLEGE
HOSPITAL AND RESEARCH INSTITUTE
MADURAI - 625009

Department of Orthopaedics

Report

Topic : Certificate course on Rehabilitation of Paraplegic

Date : 08.11.2019

Venue : Ortho OPD Demo Hall, VMCH & RI

Target Audience : Prefinal year students

Number of participants: 25

A certificate course on Rehabilitation of Paraplegic was organised by Department of Orthopaedics to Prefinal year students on 08.11.2019. 25 Prefinal year students participated in the course. The program began by 08.30 am with pretest followed by Introduction, Positioning, Therapeutic exercises, Functional ambulation, Transportation implications, Assessment. The program concluded with a vote of thanks. Pretest and posttest were conducted to sensitize the students with topic content and grade their knowledge gain of the course.

Outcome:

Students learnt about the concepts of Rehabilitation of Paraplegic. The gained idea about Rehabilitation of Paraplegic.

Prof. T. THIRUNAVUKKARASU, M.D.,D.A.,
Dean
Velammal Medical College Hospital
and Research Institute
"Velammal Village"
Madurai-Tuticorin Ring Road
Anuppanadi, Madurai-625 009, ...V.

Department of Orthopaedics

VELAMMAL HOSPITAL
the healing touch

Certificate Course

Title:

Rehabilitation of All Amputee

Date: 02.03.2020

Day: Monday

Venue: Lecture Hall

Duration: 8 hours

AGENDA

TIME	TOPIC	SPEAKER
8.30 am to 09.00 am	Introduction	Dr. V. Raviraman
9.00 am to 11.00 am	Acute past surgical management	Dr. S. Shanmuganathan
11.00 am to 01.00 pm	Pre – Prosthetic rehabilitation	Dr. K.N. Subramanian
01.00 pm to 01.30 pm	Lunch	
01.30 pm to 02.30 pm	Muscle strengthening	Dr. M. Subbiah
02.30 pm to 03.30 pm	Prosthetic training	Dr. S. Lokesh kumar
03.30 pm to 04.30 am	Assessment	Dr. R. Hari sudhan

Teaching method power point presentation, interactive discussion


DEPARTMENT OF
ORTHOPAEDICS
Name of the Event :
Event Coordinator :
Date :
Venue:
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Velammal Medical College hospital Madurai-Tuticorin Ring Road, Velammal, Anuppanadi Near Chinthamani, Toll Gate, V5P2+R2F, Chinthamani, Tamil Nadu 625009, India
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Long 78.150208°
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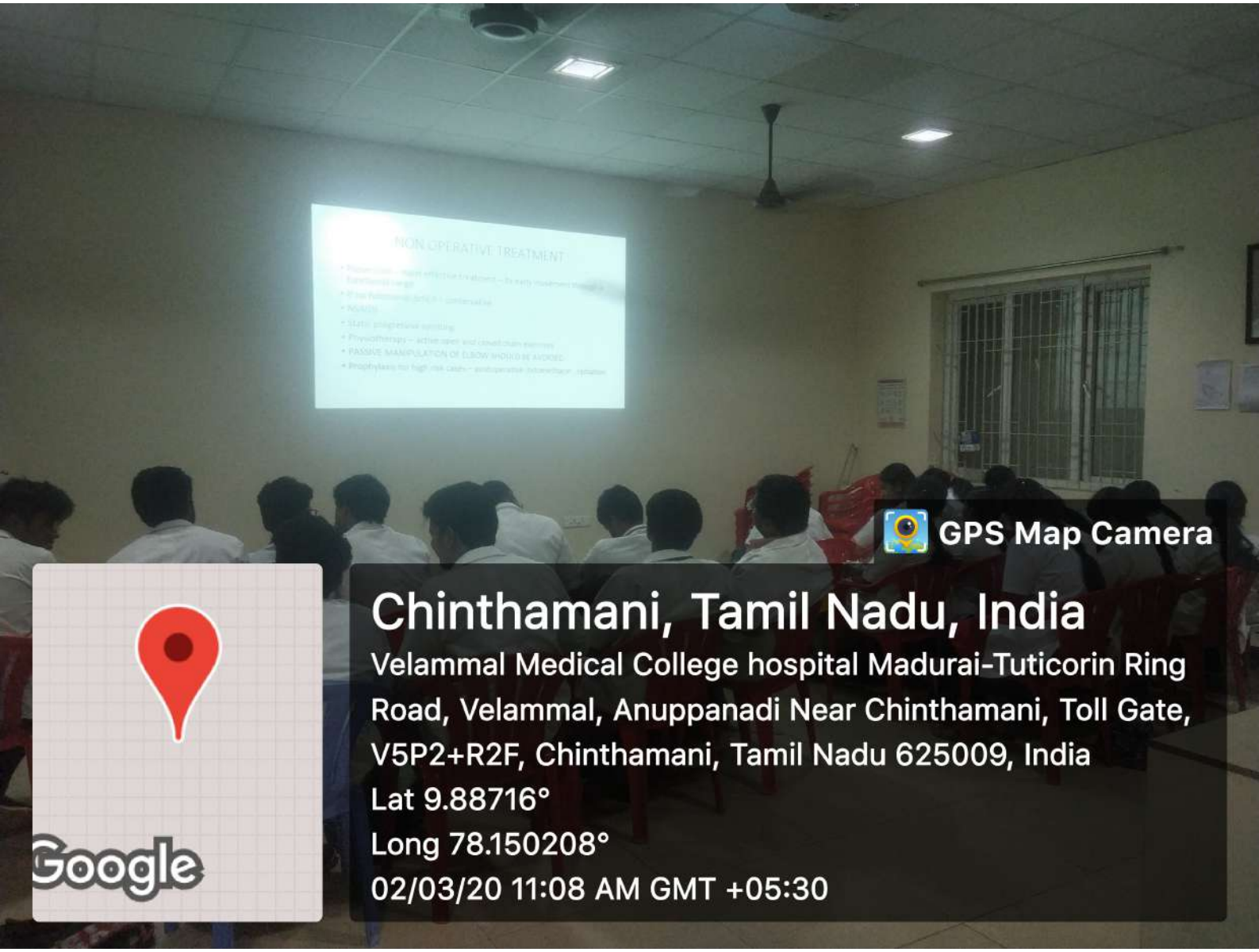
Google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Long 78.150208°
02/03/20 11:09 AM GMT +05:30
Google

From

Dr. V. Raviraman
Department of Orthopaedics
Velammal Medical College Hospital and RI
Madurai

To:

The Dean
Velammal Medical College Hospital and RI
Madurai

Respected Sir:

We from the department of Orthopedics are planning to conduct a Certificate Courses – **"REHABILITATION OF ALL AMPUTEE"** on 02/03/2020 involving Ortho posting M.B.B.S Students & CRRIs. We kindly request you to give permission to conduct the same. Kindly do the needful.

Thanking You

Date: 20.02.2020

Place: Madurai

Yours sincerely,

Dr. V. Raviraman
Head of the Department

2/3/20

Prof. T. THIRUNAVUKKARASU, M.D., D.A.,
Dean
Velammal Medical College Hospital
and Research Institute
"Velammal Village"
Madurai-Tuticorin Main Road
Anuppanadi, Madurai, T.N. 625 009

VELAMMAL MEDICAL COLLEGE HOSPITAL & RESEARCH INSTITUTE

DEPARTMENT OF ORTHOPAEDICS

CERTIFICATE COURSE

TOPIC: REHABILITATION OF ALL AMPUTEE

DATE : 02/03/2020, TIME : 08.30 AM TO 04.30 PM VENUE : ORTHO OPD DEMO HALL

PARTICIPANT'S LIST

S.NO	FACULTY NAME	Sign
1	Dr. V. Raviraman	
2	Dr. S. Shanmuganathan	
3	Dr. Ganesan G Ram	
4	Dr. K. N. Subramanian	
5	Dr. M. Subbiah	
6	Dr. R. Hari sudhan	
7	Dr. Muthu kumar . S	
8	Dr. S. Lokesh Kumar	
9	Dr. E. Vijaya raja	
10	Dr. M.J. Krishna kumar	
11	Dr. S. Dheepan Kumar	
12	Dr. V Janarthanan	
	PREFINAL YEAR STUDENTS	
1	SHRI HARINI K	
2	SHRI NIDHI G	
3	SHRIRANJANI S S	
4	SIVAKUMAR S	
5	SIVAN T	
6	SOBANA K	
7	SOORYA S	

8	SORNA M	
9	SREHARSNI V	
10	SRILEKHA E	
11	SUPRIYA M	
12	SURYA R	
13	SURYAKUMAR S	
14	SUSILA S	
15	SUSITHRAN G P F	
16	SWATHI BALA G	
17	TAMILVANAN A	
18	THANISK R	
19	UNNADHAN M	
20	VAIRA PRAVEENA R	
21	VIGNESH KUMAR M S	
22	VIJAY BALAJI B	
23	VIJAYA JOTHI B	
24	VISALI B	
25	YAZHINI N J	

Dr. RAVI RAMAN
Orthopedic Dept.
VMCH & RI
Madurai-625 009

REHABILITATION OF ALL AMPUTEE

- The main goal of rehabilitation is to prevent any complications of immobility.
- Other goals include patient education, conditioning, functional training,and psychologic support.

- Rehabilitation prog can be divided into
- 1.Pre-op period
- 2.Post-op period which is in
  - a.Preprosthetic stage
  - b.Prosthetic stage
- 3.Community and vocational rehabilitation
- 4.Life long management and follow-up

Exercise for the person with an amputation

- *A person with an amputation improves greatly if he is taught some of the basic goals of exercising, which are:*

1. To improve or maintain the range of motion of all the limbs.

2. To Improve the strength of the limbs.

3. To Improve endurance for daily activities.

Pre- prosthetic Rehab

Involves

- Stump shaping and shrinking
- Care of stump
- Desensitisation
- ROM and muscle strengthening
- progressive functional mobility training without a prosthesis,
- restoring locus of control of the patient
- patient education and preparation for prosthetic use.

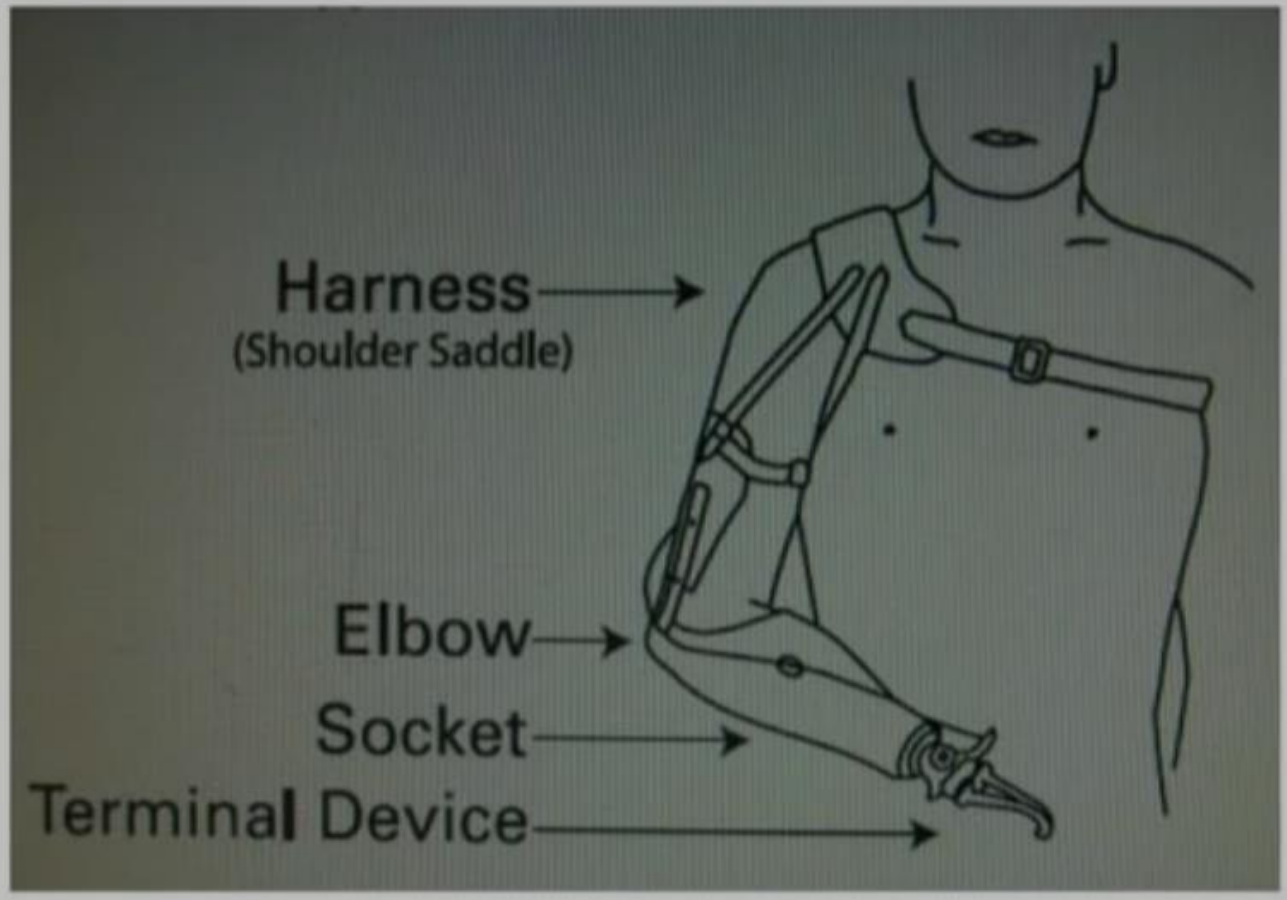
Prosthetic Training

- Prosthetic management and training to increase wearing time and functional use.
- For patients with AKA and BKA using a soft dressing after amputation, a cast for a temporary socket is often fabricated 6-8 weeks postoperatively.
- Ambulation activities with a lower limb prosthesis often begin during weeks 10-11 after amputation.
- The more proximal the amputation, the more energy is demanded from the cardiovascular and pulmonary systems for prosthetic gait.

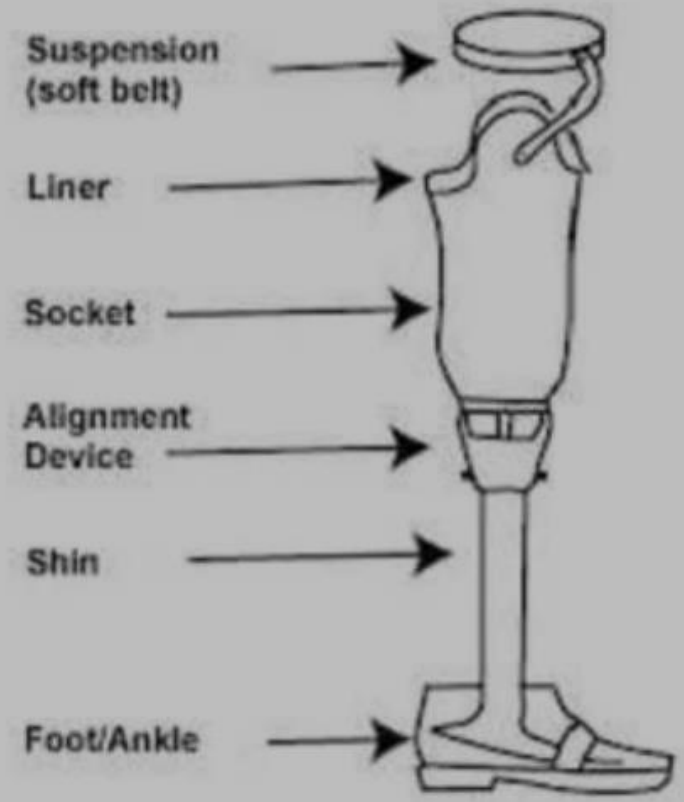
Gait Training

- Posture
- Even weight bearing
- Proprioception with weight shifting
- Weight transfer in stance

Parts of prosthesis



Parts in lower limb prosthetic



Type of prosthses

- two types –
  - active (mechanical)
  - or passive (purposely without internal mechanical units)
- Active prostheses are no more than simple clamping devices that have none of the manipulating capability characteristic of our hands. They may be body powered or externally powered.

- Passive prostheses purposefully have no internal mechanical units, but best meet the needs of the vast majority of hand amputees today as the big numbers are in partial hand and digital amputations. While not containing motors, the digits of passive prostheses can be constructed with armatures that permit change in their configuration by the normal hand.

Contraindications to aesthetic prostheses

- Lack of motivation or unrealistic expectations
- Voluminous or poorly aligned stump prevents
- Prostheses that does not confirm to the patient's specific needs

Vocational Rehabilitation

- Involves assessment and training for work activities, and assessment of further education needs or job modification
- On the basis of residual functional capacity, patients may be able to return to their previous line of work. In many cases patients' may choose a different line of work,dependent on the physical demands of the job.
- For the successful reintegration of the amputee, return to work should take place gradually, with time and workload increasing over several weeks and clinical staff being available for counseling and consultation

Psychological support

- Providing information is important
  - to reduce the person's and the family's anxiety,
  - obtain cooperation in the treatment program
  - to help the person with an amputation to adjust to his new condition.

- Feeling of complete change in reality due to
  - lack of function
  - alteration of limb sensation
  - change in body image
  - lack of understanding of medical treatments

VELAMMAL MEDICAL COLLEGE
HOSPITAL AND RESEARCH INSTITUTE
MADURAI - 625009

Department of Orthopaedics

Report

Topic : Certificate course on Rehabilitation of All Amputee

Date : 02.03.2020

Venue : Ortho OPD Demo Hall, VMCH & RI

Target Audience : Prefinal year students

Number of participants: 25

A certificate course on REHABILITATION OF ALL AMPUTEE was organised by Department of Orthopaedics to Prefinal year students on 02.03.2020. 25 Prefinal year students participated in the course. The program began by 08.30 am with a pretest followed by Introduction, Acute past surgical management, Pre prosthetic rehabilitation, Muscle strengthening, Prosthetic training & Assessment. The program concluded with a vote of thanks. Pretest and posttest were conducted to sensitize the students with topic content and grade their knowledge gain of the course.

Outcome:

Students Learnt About The Concepts of Rehabilitation of All Amputee. The Gained Idea About Rehabilitation of All Amputee.

Prof. T. THIRUNAVUKKARASU, M.D.,D.A.,
Dean
Velammal Medical College Hospital
and Research Institute
"Velammal Village"
Madurai-Tuticorin Ring Road
Anuppanadi, Madurai-625 009, T.N.

VELAMMAL MEDICAL COLLEGE
HOSPITAL & RESEARCH INSTITUTE

DEPARTMENT OF RADIODIAGNOSIS

POINT OF CARE ULTRASOUND (POCUS)

CERTIFICATE COURSE

VELAMMAL MEDICAL COLLEGE HOSPITAL & RESEARCH INSTIUTE

POINT OF CARE ULTRASOUND (POCUS)

CERTIFICATE COURSE

Department of Radiodiagnosis

Date: 10.03.2020
Time: 10 am – 12 pm
MBBS Students (Final Year)



DEPARTMENT OF RADIODIAGNOSIS
CERTIFICATE COURSE – POINT OF CARE ULTRASOUND (POCUS)
10.03.2020

S.No	Name	Mobile Number	Signature
1	KISHORE MANIA SK	9944824441	
2	HRUDAYNATH MADHAV MENON	7358486470	
3	K. JAYAHARI	6383330258	
4.	M.S. KAMALAKANNAN	7358996271	
5	T. JAYASURYA	9840735148	
6	S. Karthikheyan	8428605650	
7.	T. Gowshigan	6382823331	
8.	N. IJAZ MOHAMED	9894047194	
9.	S. KUMARAN	8270380566	
10.	C.I. JOSEPH THARAKAN	9176363111	
11	Krishna Priya	8848518799	
12.	K. Pooja	8247866911	
13.	K.R. KAVITHA	9840789627	

Point of Care Ultrasound (PoCUS): Introduction

George A. Fox MD, MSc, FRCPC, FCCP

PDCS
Professional Development and Conferencing Services

MEMORIAL UNIVERSITY

Financial Disclosure:

Within the past 5 years, I have received financial sponsorship, honoraria and hospitality from the following pharmaceutical companies:

- Actelion
- Astra-Zeneca
- Bayer HealthCare
- Boehringer Ingelheim
- InterMune
- Novartis

Learning Objectives:

At the end of this session and workshop, the participant(s) will:

- NOT be skilled ultra-sonographer's
- NOT be able to perform a comprehensive "consultative" ultrasound procedure
- Recognize that ultrasound equipment in the hands of an inexperienced operator may cause patient harm
- Recognize your limitations in bedside ultrasound and outline steps to improve your skills

PoCUS

Definition:

- An ultrasound examination provided and performed at the bedside by the primary care physician (or their designate), usually as an adjunct to the physical examination, to identify the presence or absence of a limited number of specific findings.

PoCUS

- Findings from the PoCUS examination MUST be correctly integrated into the clinical decision making process.

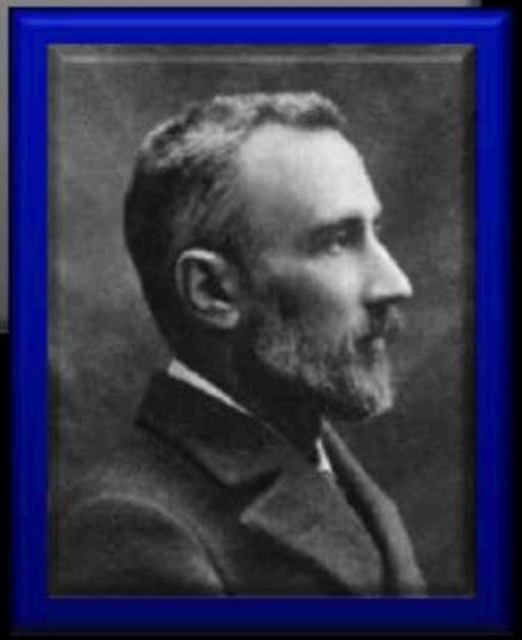
- If you are not certain of all, or part of the PoCUS examination, you should NOT rely on those uncertain findings in the clinical decision making process.

Why ultrasound?

- Portable
- Safe
- Repeatable
- Digital
- Decision support
- Battery operated
- Cost-effective
- Multi-use

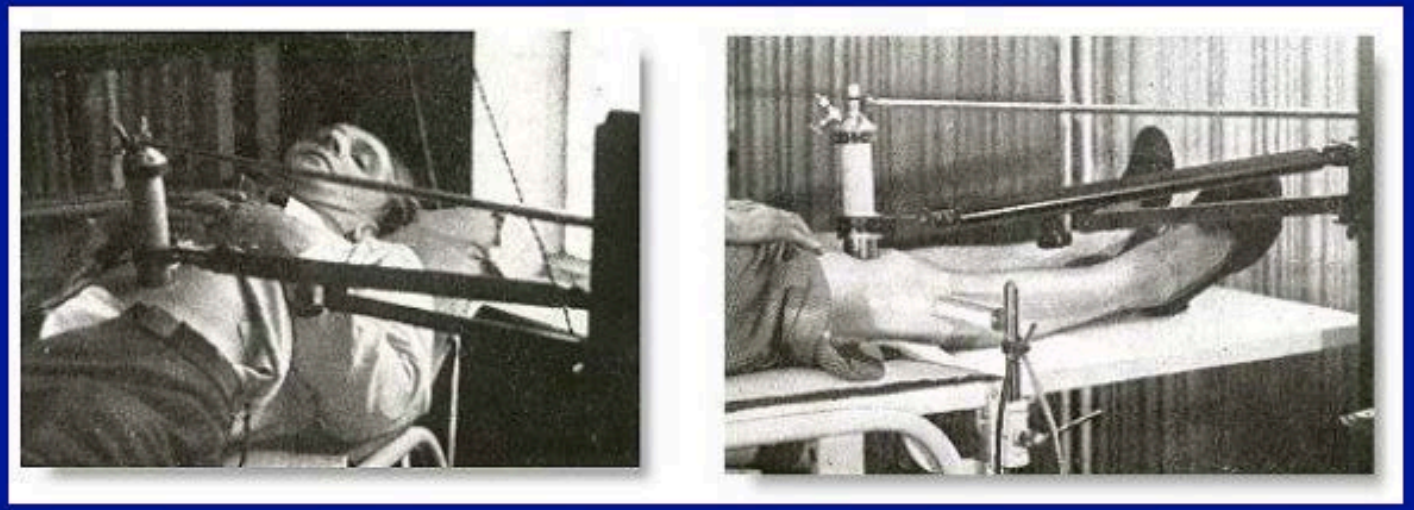
Noble, V.E., MGH, Boston, MA

- "Discovery" in the 1820's
- Industrial Use
- Military Use (SONAR)
- Medical use begins in1950's



History of Ultrasound

Early use of ultrasound focused on therapy



Treatment of gastric ulcers (left) and arthritis (right) in the 1940s.

Moak, J.H., MD, RDMS; http://www.medicine.virginia.edu

History of Ultrasound

Dussik and his apparatus in 1946

- Karl Dussik, 1946
  - University of Vienna in Austria
  - Cerebral ventricles

Moak, J.H., MD, RDMS; http://www.medicine.virginia.edu

History of Ultrasound

Howry's somascope reported in the LIFE magazine in 1954

- Howry's somascope
- 2-D images called "somagrams"

Moak, J.H., MD, RDMS; http://www.medicine.virginia.edu

- 1950's - Radiology
- 1960's – Cardiology
- 1970's – Obstetrics & Gynecology

Cook, T. MD, Columbia, SC

ULTRASOUND FUNDAMENTALS

Many types of probes (also known as **transducers**) have been developed. A few examples are shown below:

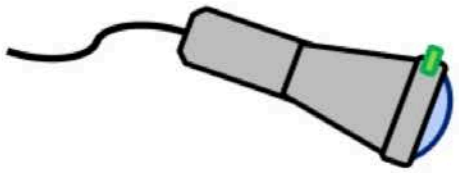
CONVEX PROBE

LINEAR PROBE

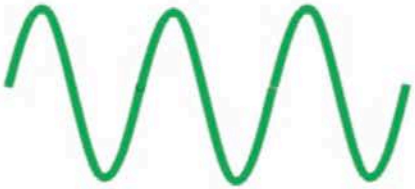
PHASED-ARRAY PROBE

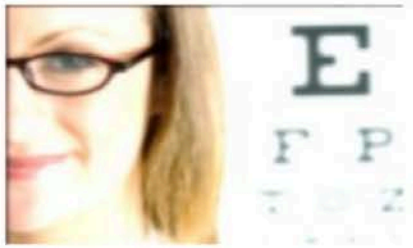
ULTRASOUND FUNDAMENTALS

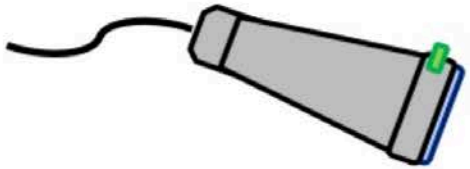
A convex probe uses a **lower** frequency range, permitting deeper tissue penetration. A linear probe uses a **higher** frequency range, allowing higher image resolution.



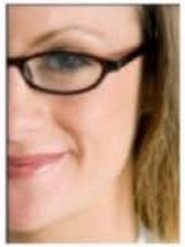
CONVEX PROBE





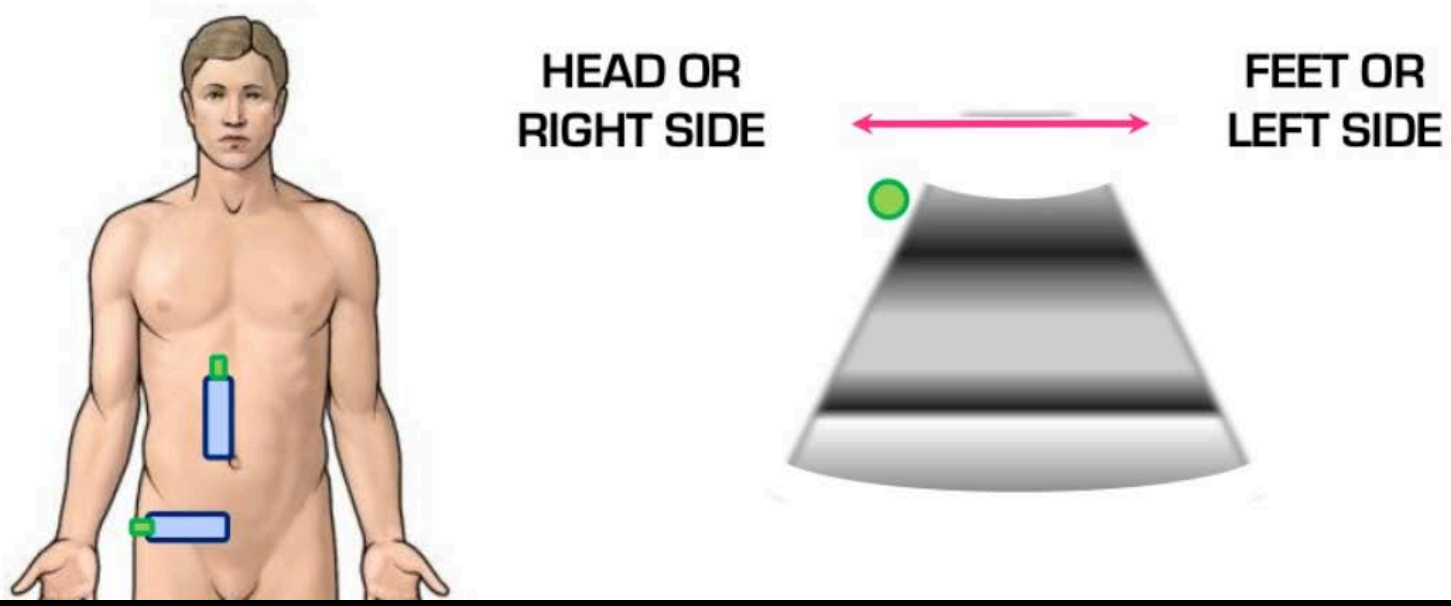


LINEAR PROBE



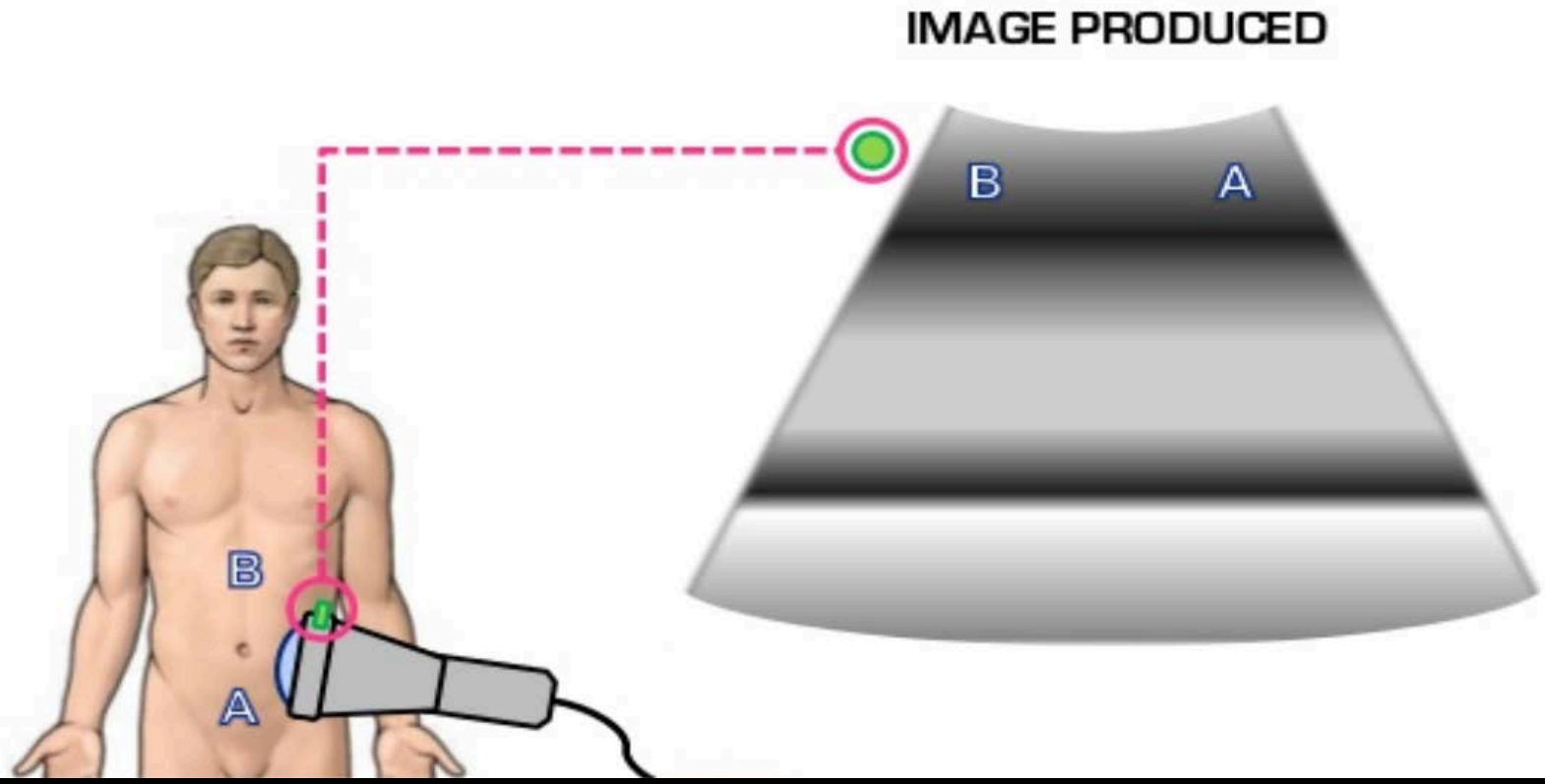
ULTRASOUND FUNDAMENTALS

The **convention** when the screen marker is on the left of the screen is that the probe marker should be directed to the patient's **head** or to the patient's **right side** when scanning.



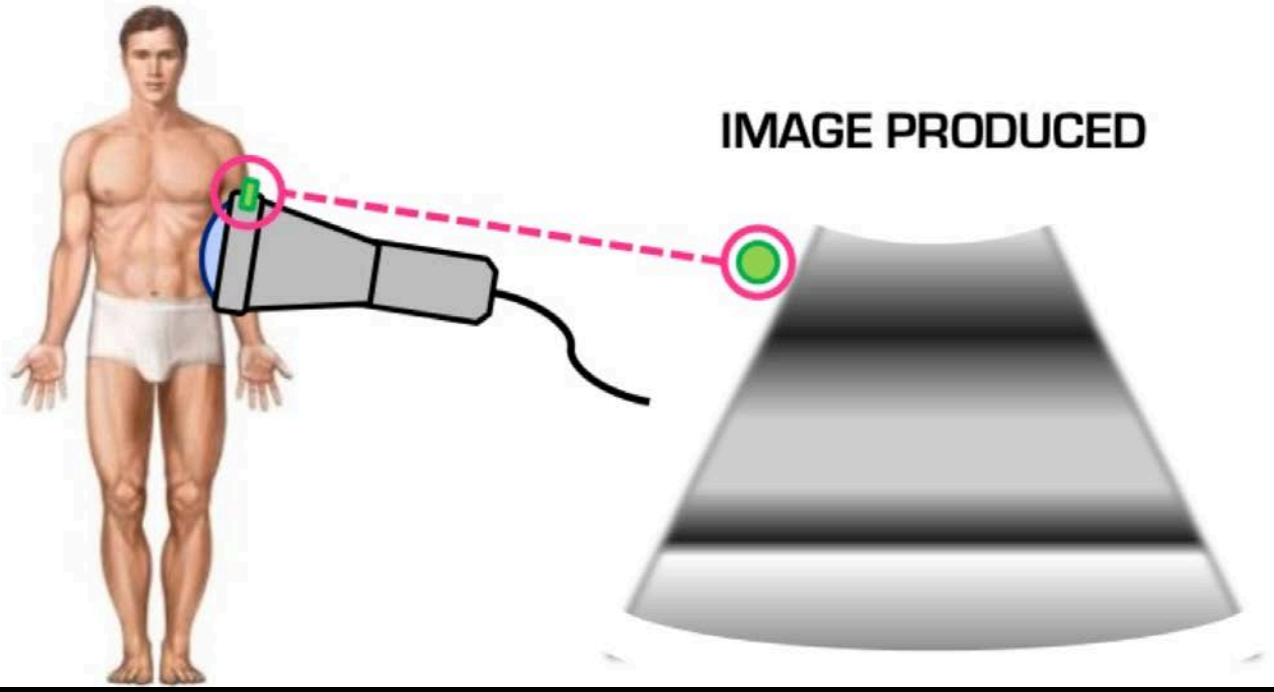
ULTRASOUND FUNDAMENTALS

Objects located closer to the probe marker will appear closer to the marker on the screen.

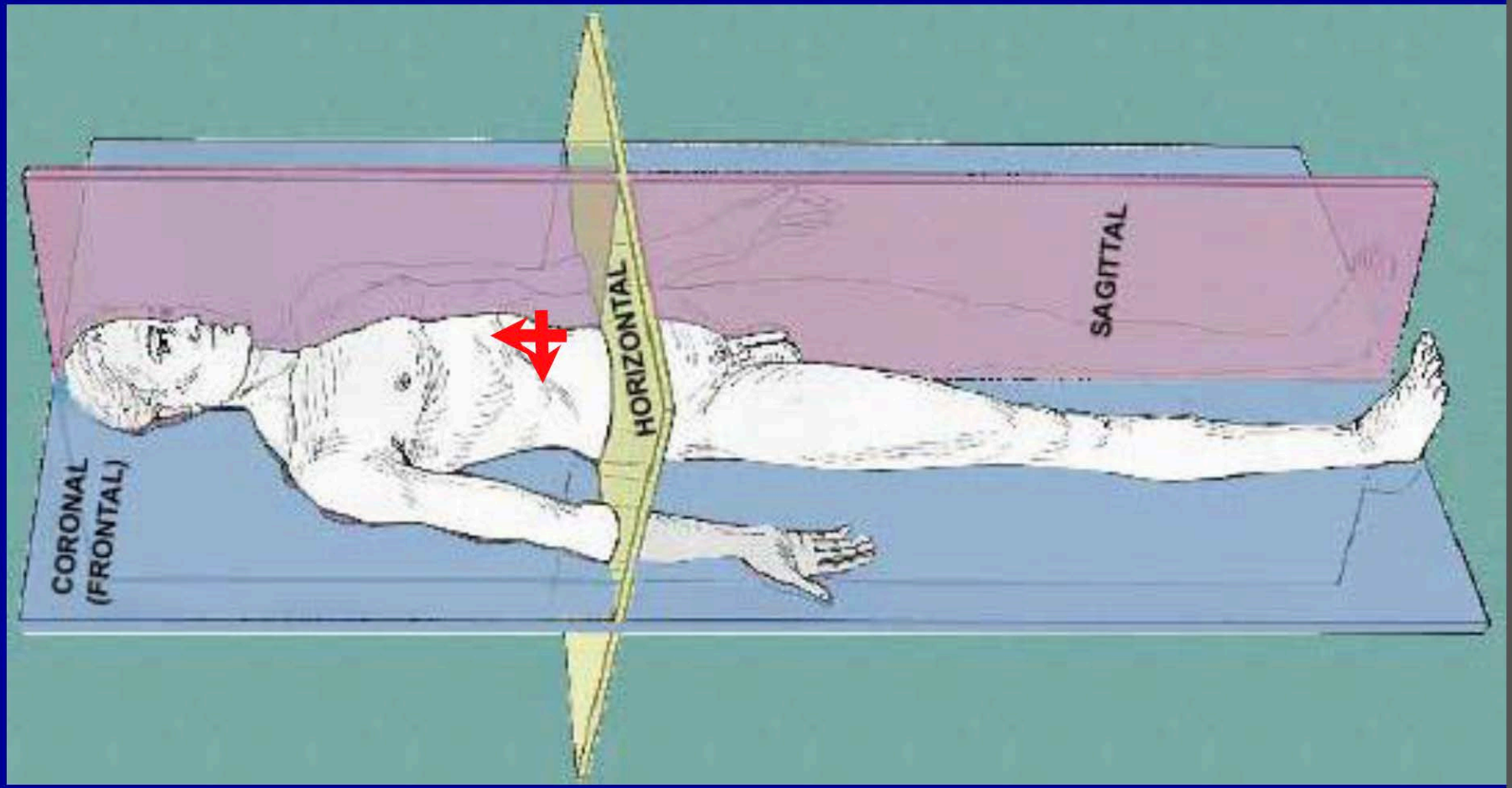


ULTRASOUND FUNDAMENTALS

Every ultrasound probe has an **orientation marker** that correlates with another **marker** displayed on the ultrasound screen.



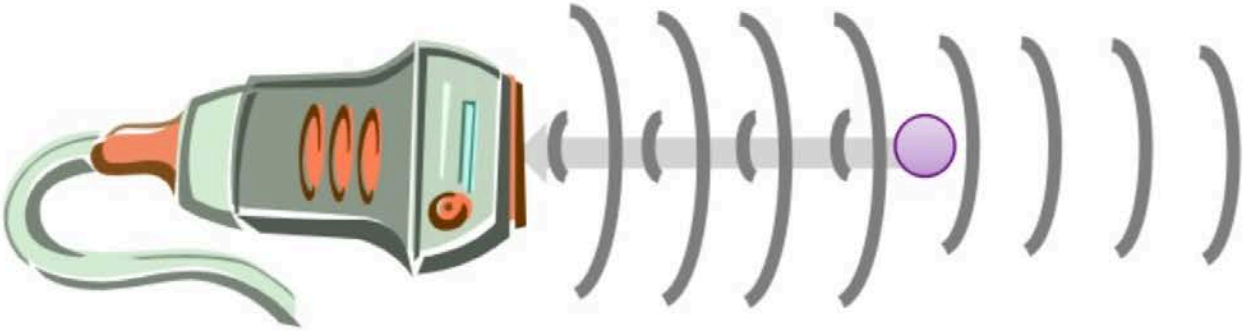
Probe Orientation



Moak, J.H., MD, RDMS; http://www.medicine.virginia.edu

ULTRASOUND FUNDAMENTALS

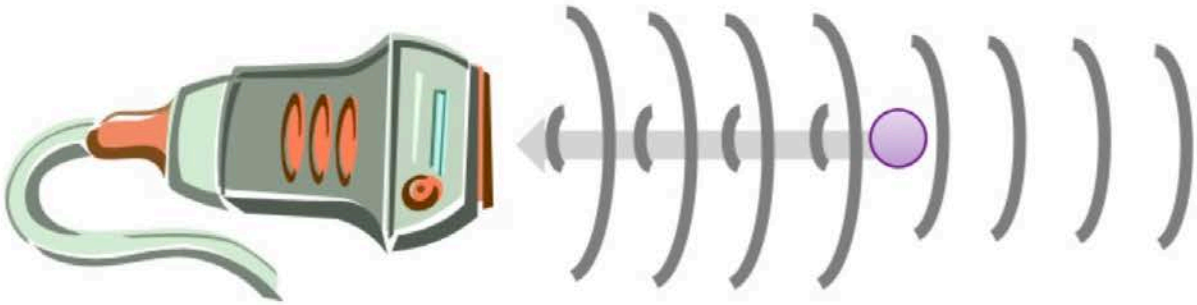
Ultrasound machines measure the **amplitude** or strength of a returning **echo**. The term echo is used to describe an ultrasound beam **returning** to its source.



Shulich School of Medicine & Dentistry, UWO; www.slideshare.net

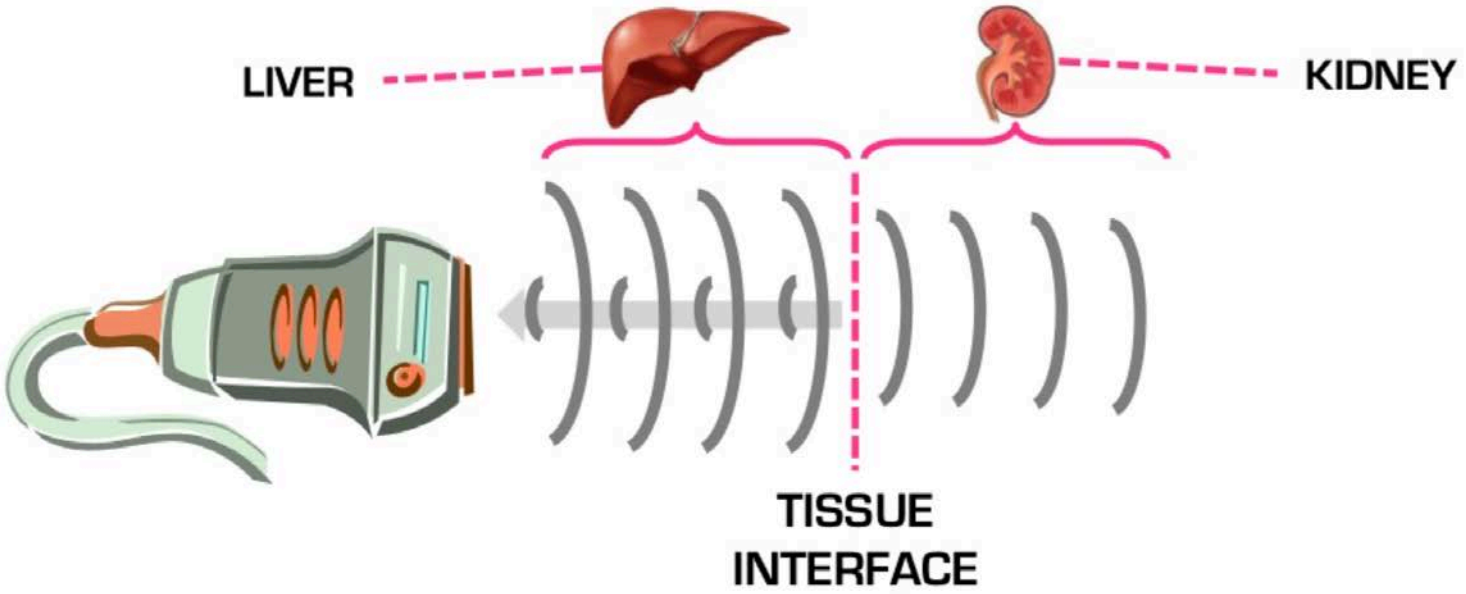
ULTRASOUND FUNDAMENTALS

An ultrasound beam can be **reflected** back to its source.



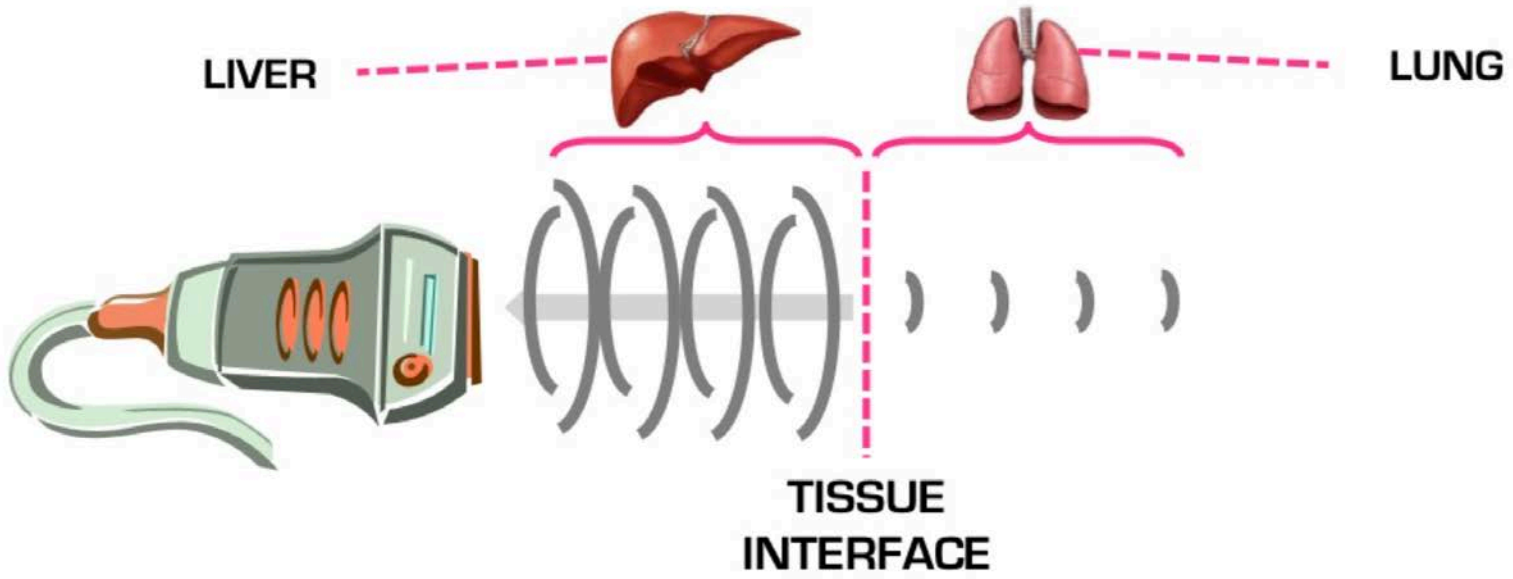
ULTRASOUND FUNDAMENTALS

An ultrasound beam reflects back to its source when it encounters an **interface** between **different** tissues or media.



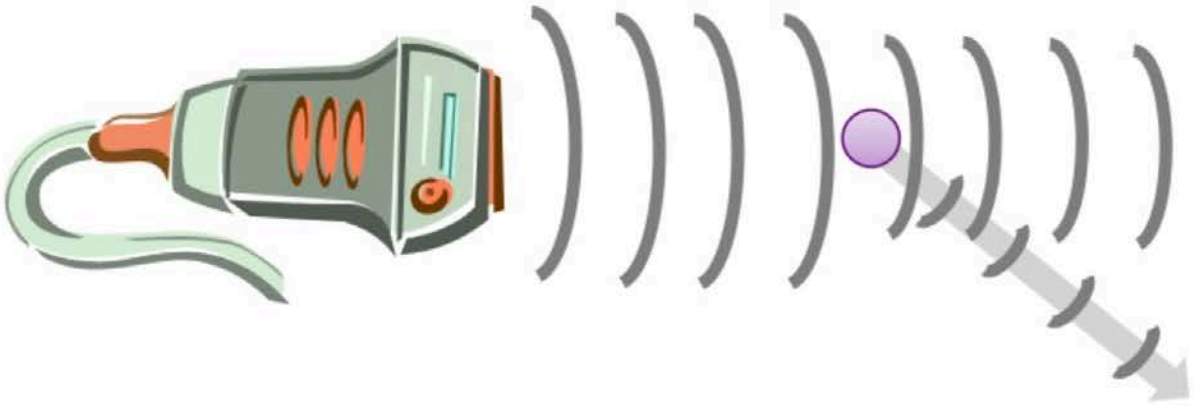
ULTRASOUND FUNDAMENTALS

Reflection at an interface **increases** when the **density** difference between two tissues at an interface **increases**.



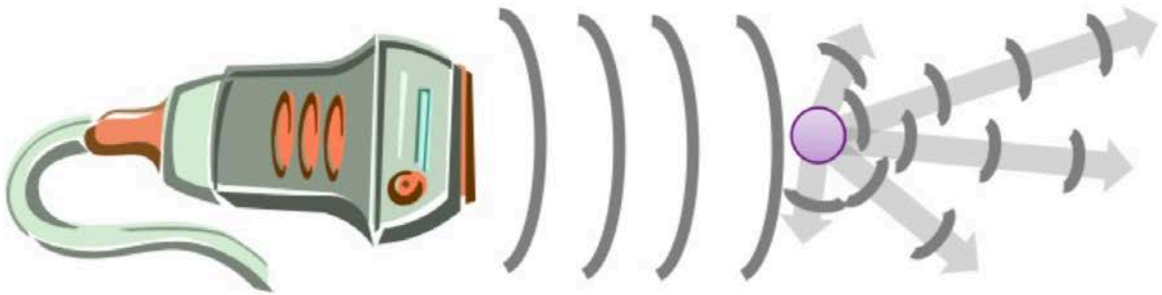
ULTRASOUND FUNDAMENTALS

An ultrasound beam can also be **refracted** in a new direction.



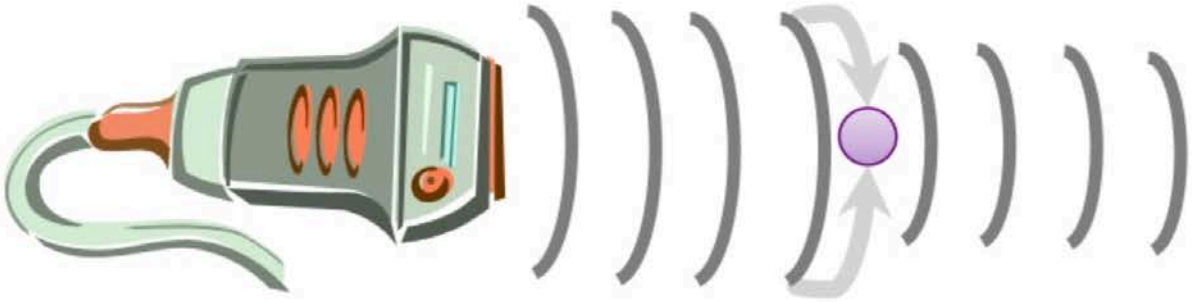
ULTRASOUND FUNDAMENTALS

Or it can be **scattered** by an irregular or small interface (such as air).



ULTRASOUND FUNDAMENTALS

Finally, an ultrasound beam can be **absorbed** by tissues that tend to hold on to acoustic energy.



ULTRASOUND FUNDAMENTALS

Strong returning echoes appear as **bright & white** (formally, **hyperechoic**) areas on the ultrasound screen. **Weak** returning echoes appear as **dark gray & black** (formally, **hypoechoic**) areas.

UNDERSTANDING THE IMAGE

There are a variety of scanning modes used in point of care ultrasound. Here we will discuss **B-** or **brightness mode**, **M-mode** or **motion mode** and **D-** or **doppler mode**.

B-MODE

M-MODE

DOPPLER

PoCUS

Table 1. Selected Applications of Point-of-Care Ultrasonography, According to Medical Specialty.*

Specialty	Ultrasound Applications
Anesthesia	Guidance for vascular access, regional anesthesia, intraoperative monitoring of fluid status and cardiac function
Cardiology	Echocardiography, intracardiac assessment
Critical care medicine	Procedural guidance, pulmonary assessment, focused echocardiography
Dermatology	Assessment of skin lesions and tumors
Emergency medicine	FAST, focused emergency assessment, procedural guidance
Endocrinology and endocrine surgery	Assessment of thyroid and parathyroid, procedural guidance
General surgery	Ultrasonography of the breast, procedural guidance, intraoperative assessment
Gynecology	Assessment of cervix, uterus, and adnexa; procedural guidance
Obstetrics and maternal–fetal medicine	Assessment of pregnancy, detection of fetal abnormalities, procedural guidance
Neonatology	Cranial and pulmonary assessments
Nephrology	Vascular access for dialysis
Neurology	Transcranial Doppler, peripheral-nerve evaluation
Ophthalmology	Corneal and retinal assessment
Orthopedic surgery	Musculoskeletal applications
Otolaryngology	Assessment of thyroid, parathyroid, and neck masses; procedural guidance
Pediatrics	Assessment of bladder, procedural guidance
Pulmonary medicine	Transthoracic pulmonary assessment, endobronchial assessment, procedural guidance
Radiology and interventional radiology	Ultrasonography taken to the patient with interpretation at the bedside, procedural guidance
Rheumatology	Monitoring of synovitis, procedural guidance
Trauma surgery	FAST, procedural guidance
Urology	Renal, bladder, and prostate assessment; procedural guidance
Vascular surgery	Carotid, arterial, and venous assessment; procedural assessment

* FAST denotes focused assessment with sonography for trauma.

NEJM 2011, 364;8: 749-57

Thoracic/Pleural Ultrasound

George A. Fox MD, MSc, FRCPC, FCCP

Learning Objectives:

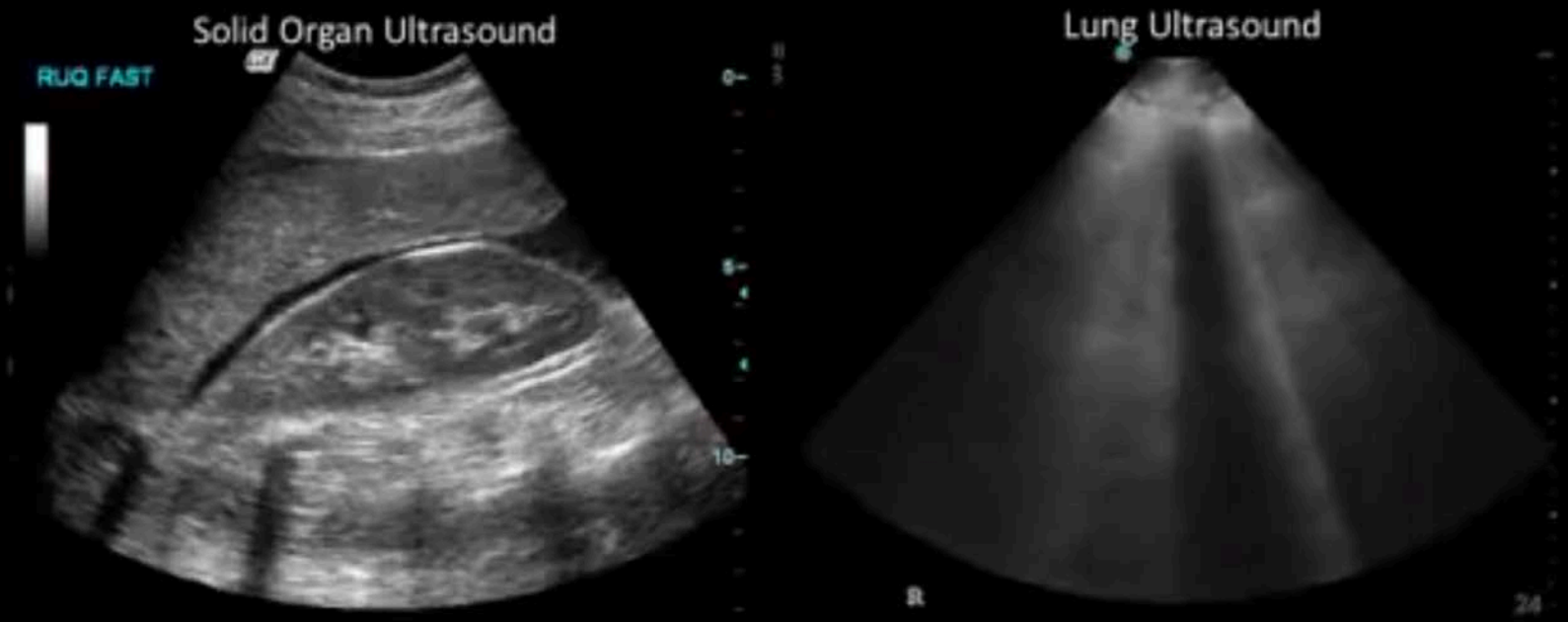
At the end of this session and workshop, the participant(s) will be able to:

- Discuss the appropriate choice of ultrasound probes
- Identify the structures when examining the lung and pleural space
- Identify the pleura, and describe the findings of a pneumothorax
- Describe how B-mode/M-mode are used to identify a pneumothorax
- Identify common ultrasound "patterns" visualized in the thorax
- Describe how to perform a thoracentesis using ultrasound guidance
- Describe static and dynamic ultrasound guidance

Thoracic Ultrasound:

http://westernsono.ca/tutorials-3/lung-ultrasound-image-interpretation-tutorial

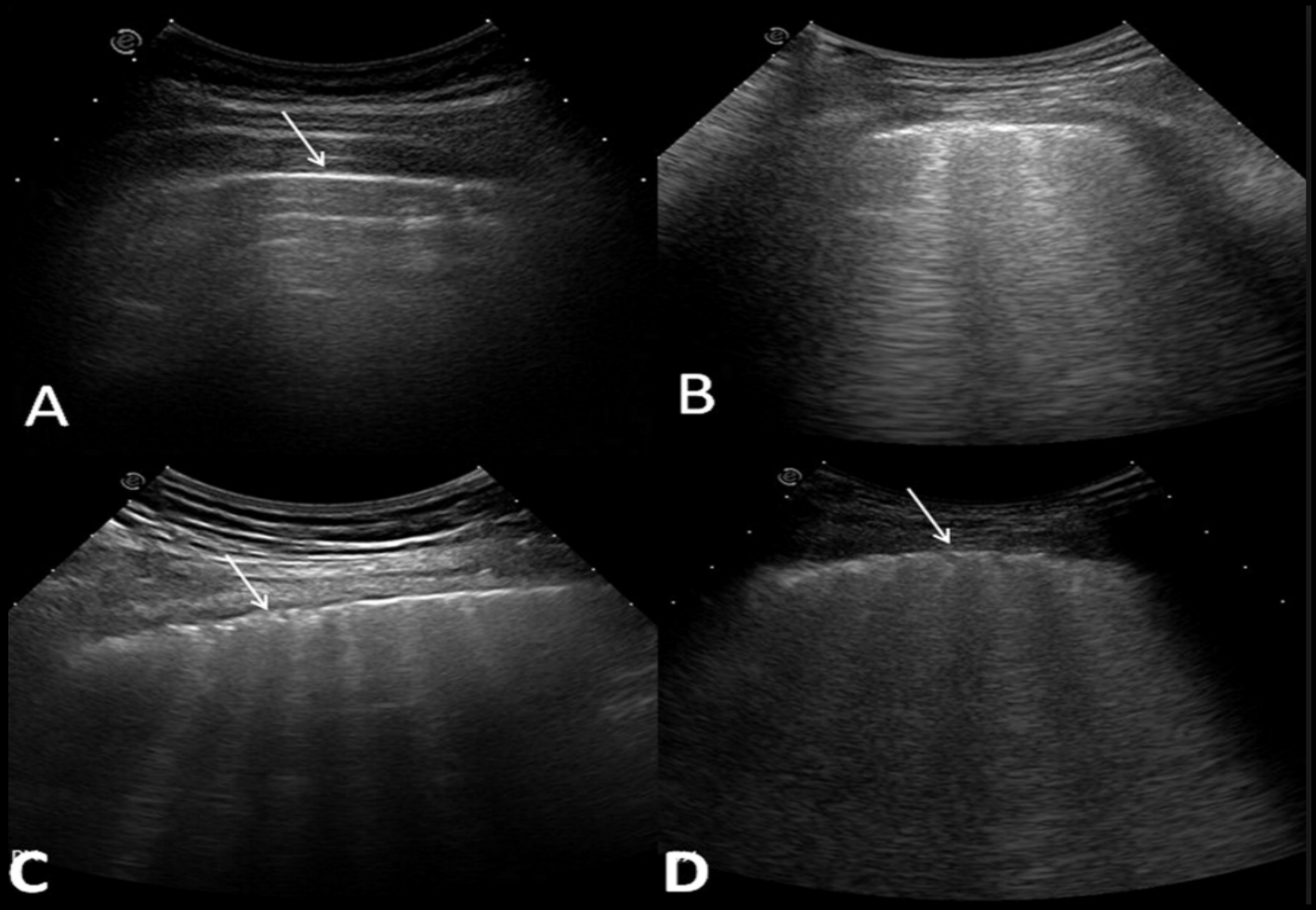
Thoracic Ultrasound:



http://westernsono.ca/tutorials-3/lung-ultrasound-image-interpretation-tutorial

Thoracic Ultrasound:

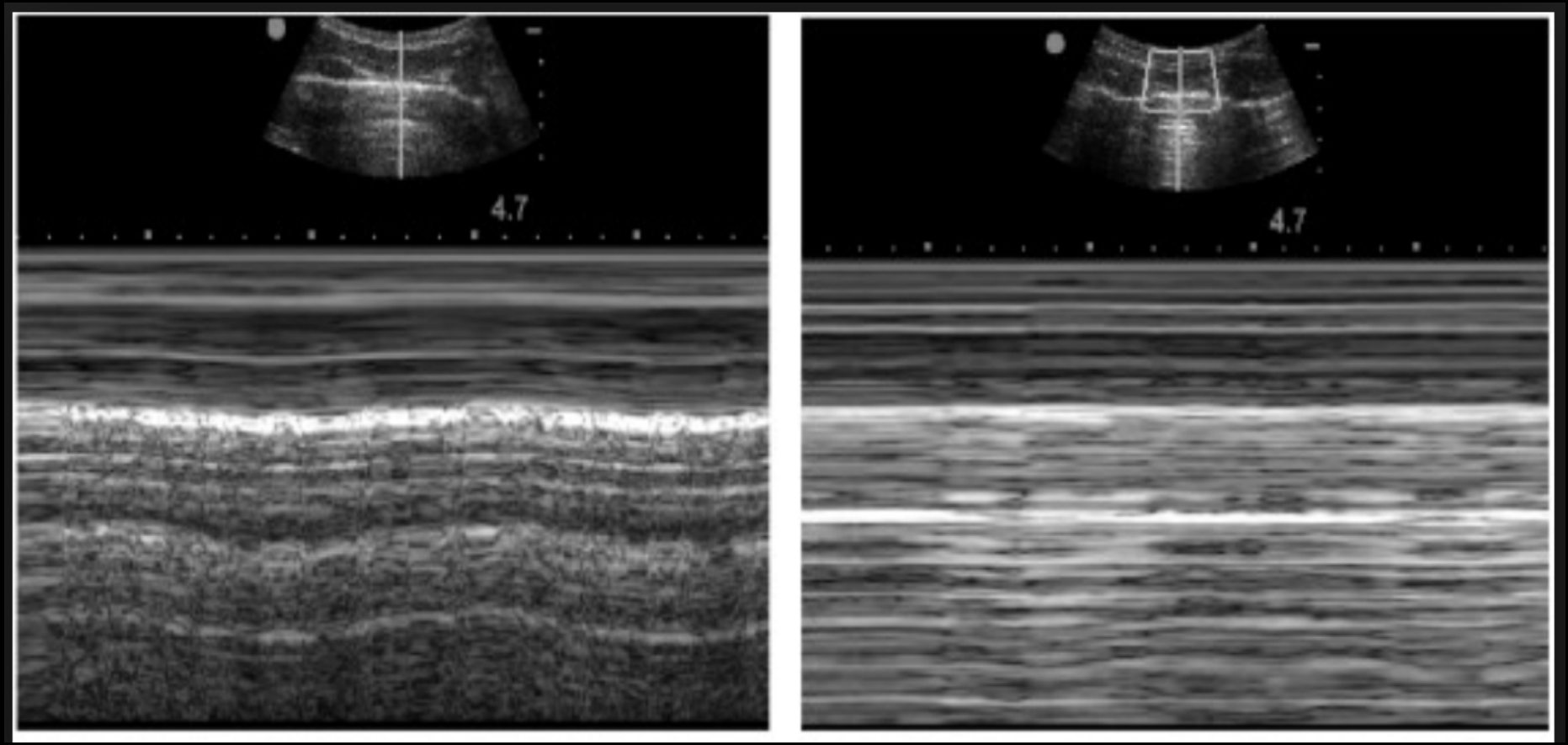
B-mode:



http://www.jrheum.org/content/39/8/1641

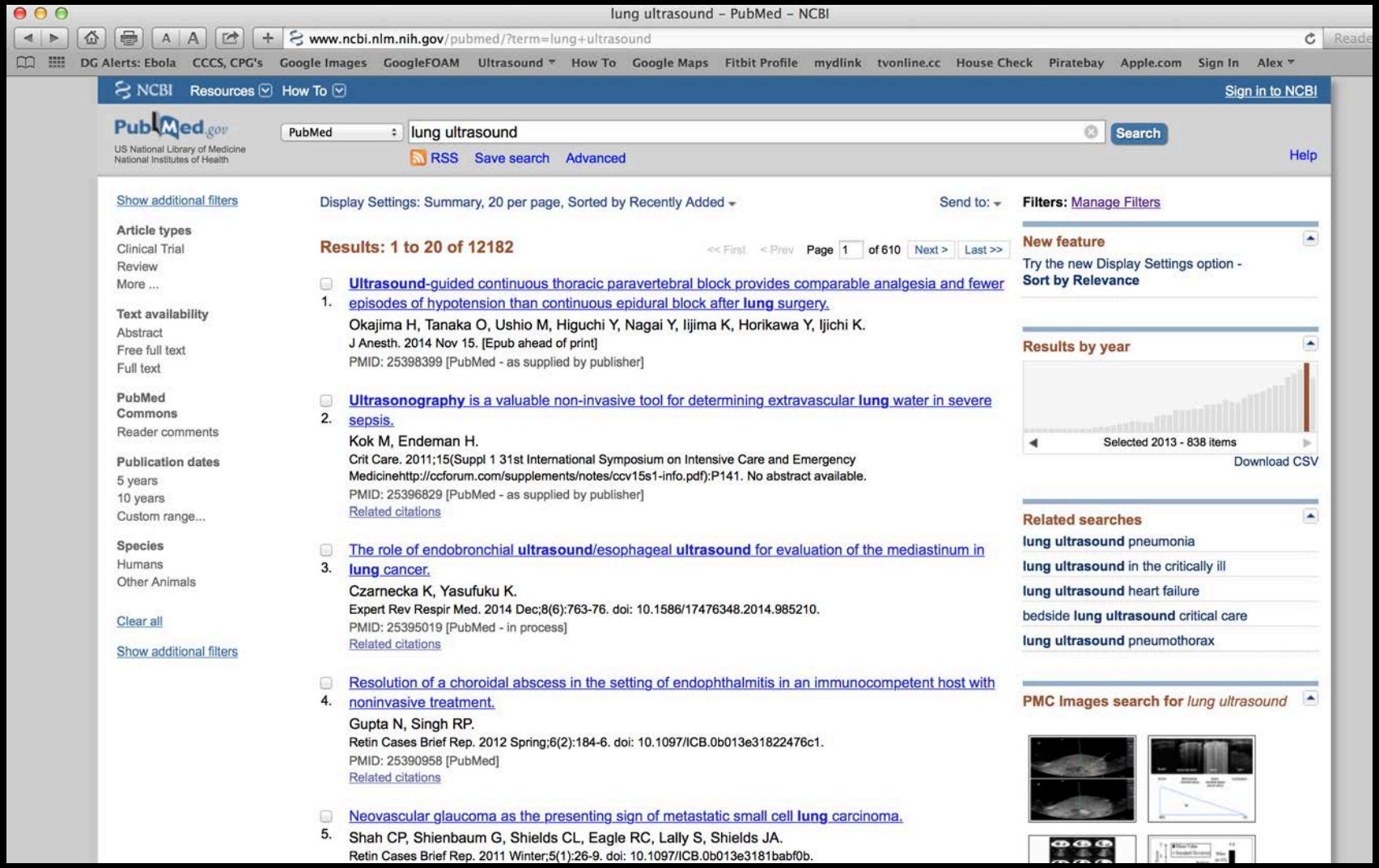
Thoracic Ultrasound:

M-mode:



http://www.icmteaching.com/ultrasound/lung%20ultrasound/styled-125

Thoracic Ultrasound:

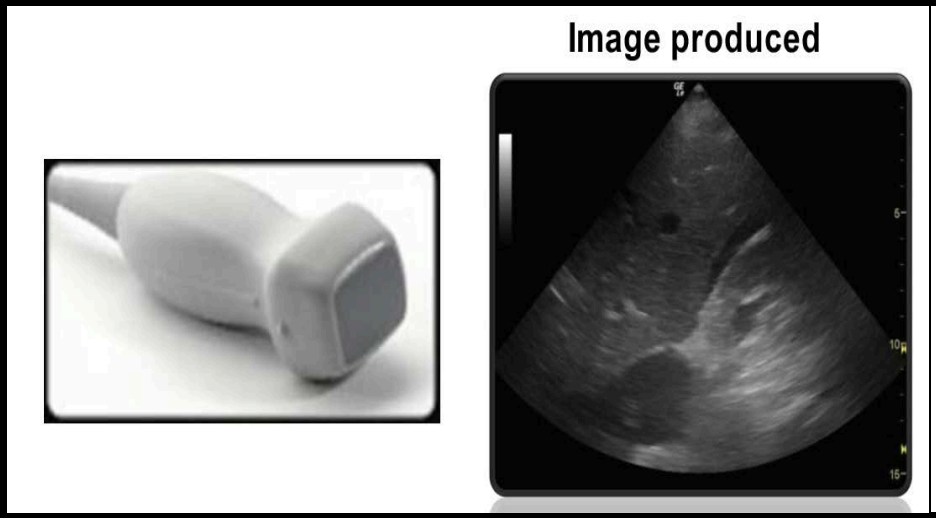


http://www.ncbi.nlm.nih.gov/pubmed/?term=lung+ultrasound

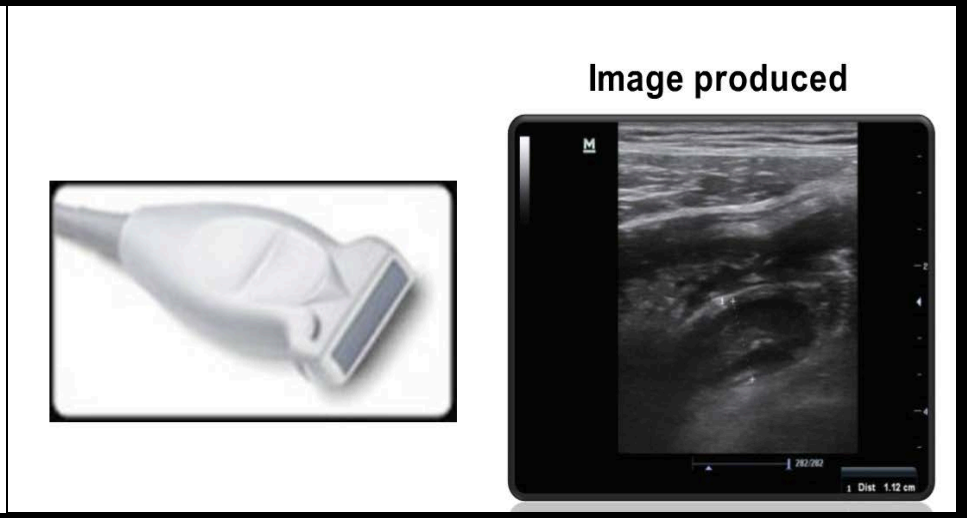
Thoracic Ultrasound:

Probes:

Phased Array Probe



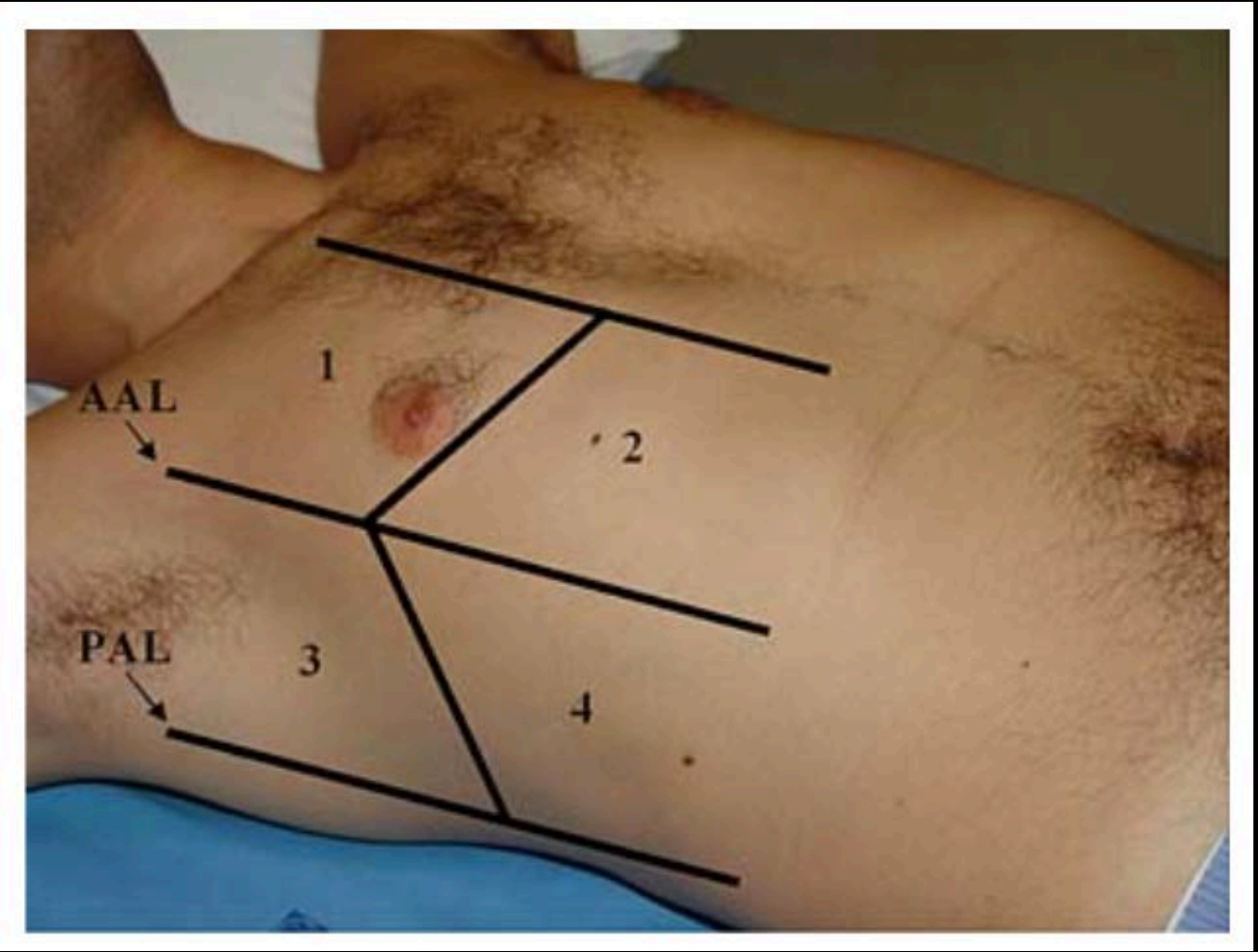
Linear Vascular Probe



http://westernsono.ca/tutorials-3/lung-ultrasound-basics-tutorial

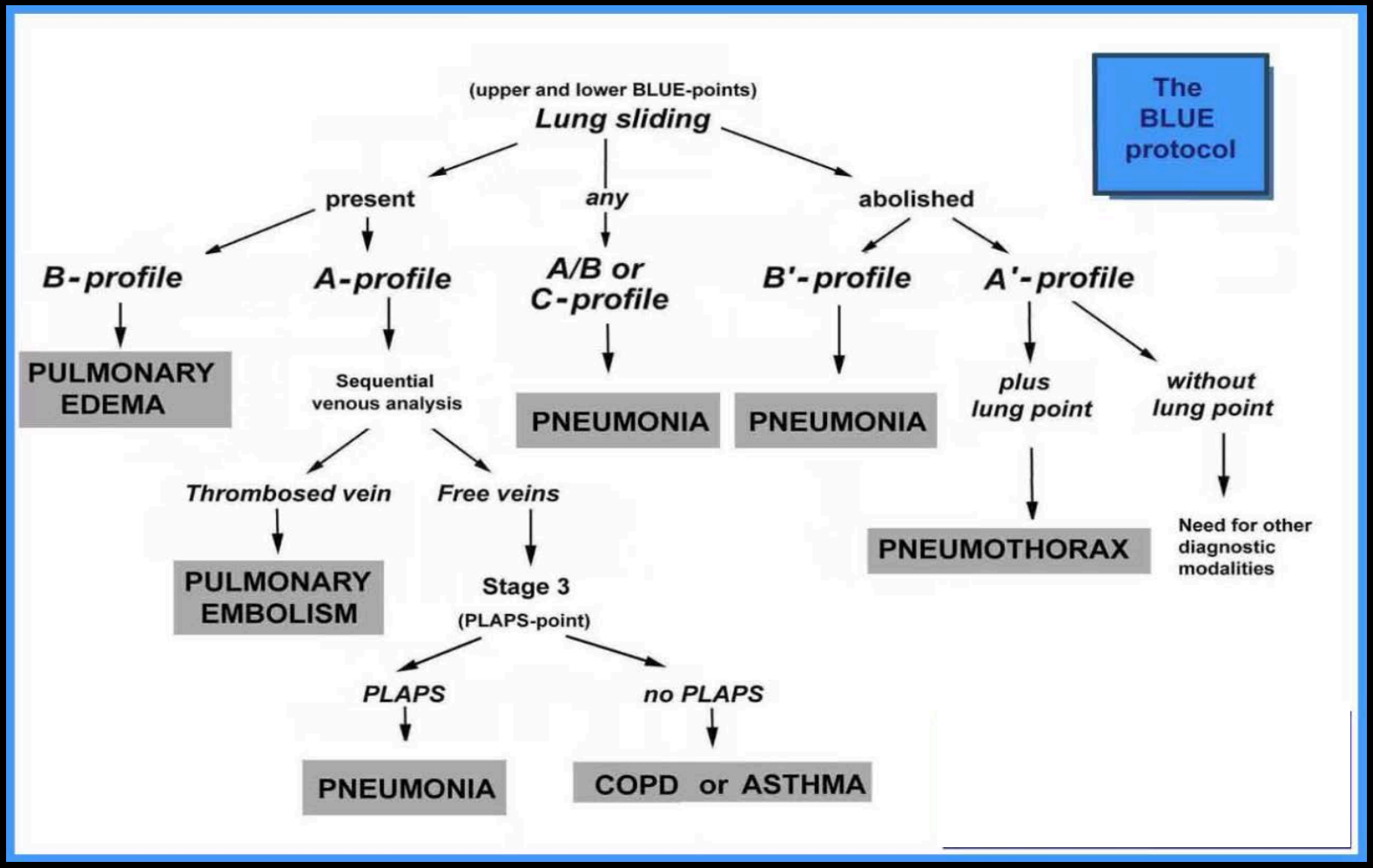
Thoracic Ultrasound:

Probe Location:



Volpicelli, G., Emerg Radiol, 2008: 15:145-51

Thoracic Ultrasound:



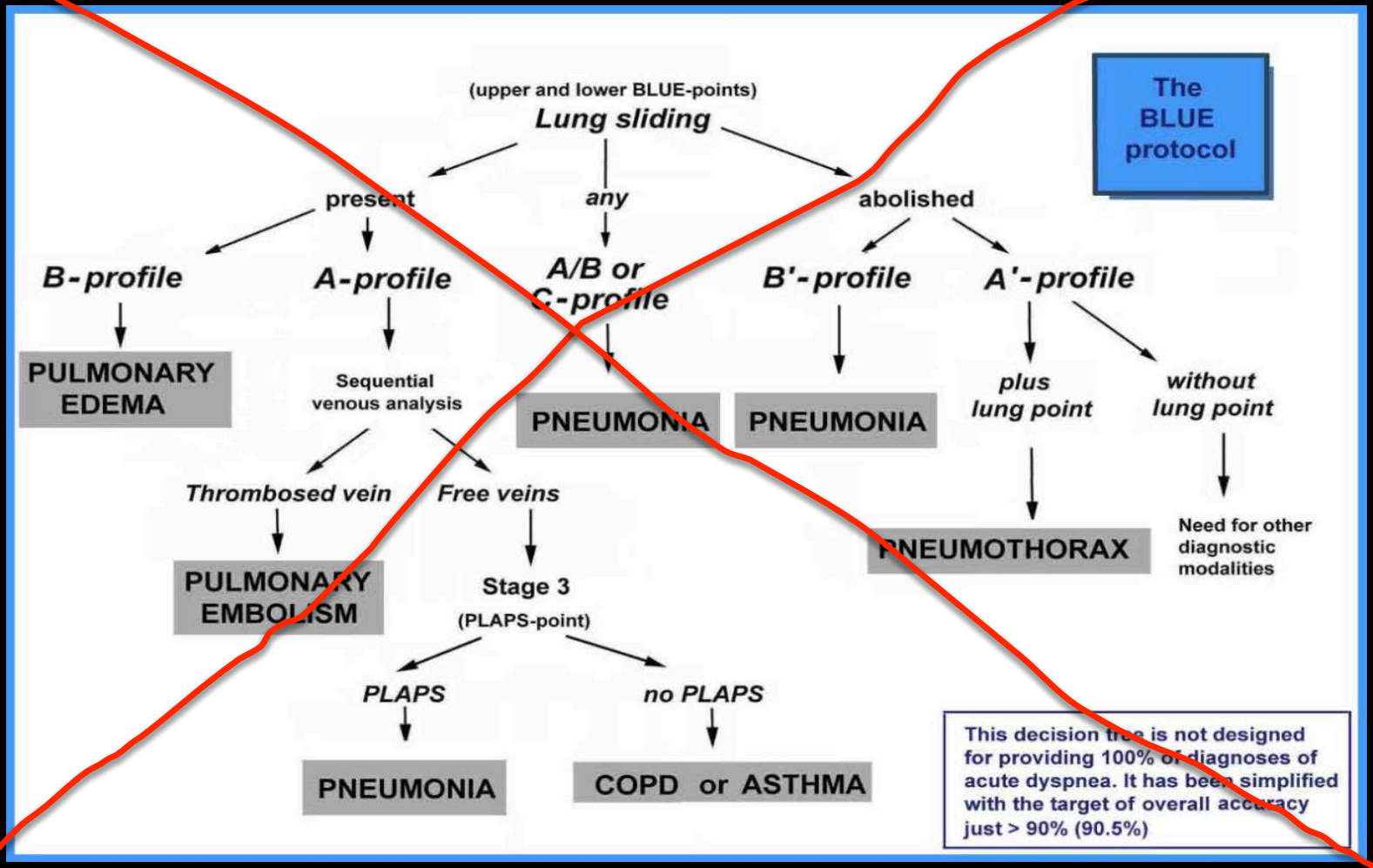
Lichtenstein, D., CHEST 2008, 134:117

Thoracic Ultrasound:

	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Pleural Effusion	94	97	95	90
Alveolar Consolidation *(Pneumonia)*	90	98	88	95
Interstitial Syndrome *(CHF, ARDS)*	93	93	87	99
Complete Pneumothorax	100	96	100	98
Occult Pneumothorax	79	100	89	99
AECOPD	89	97	93	95
Pulmonary Embolism	81	99	94	98

Lichtenstein, D., Ann Int Care, 2014; 4:1-12

Thoracic Ultrasound:



Lichtenstein, D., CHEST 2008, 134:117

Thoracic Ultrasound:

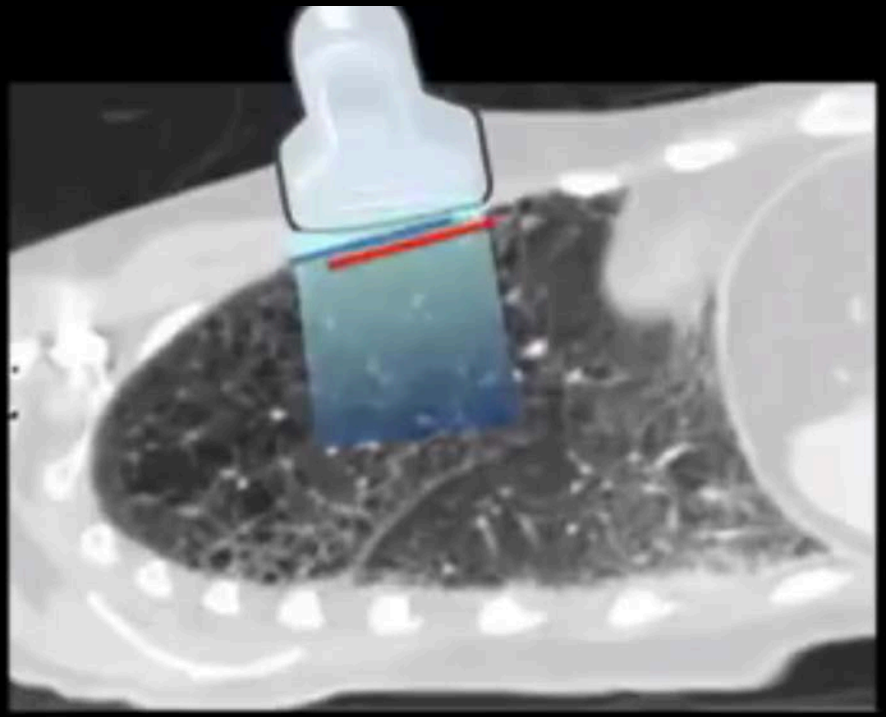
5 sonographic "signs" used in the BLUE Protocol:

- Sliding Lung
- A Lines
- B Lines
- Alveolar Consolidation
- Pleural Effusion

Thoracic Ultrasound:

Lung Sliding:

Present

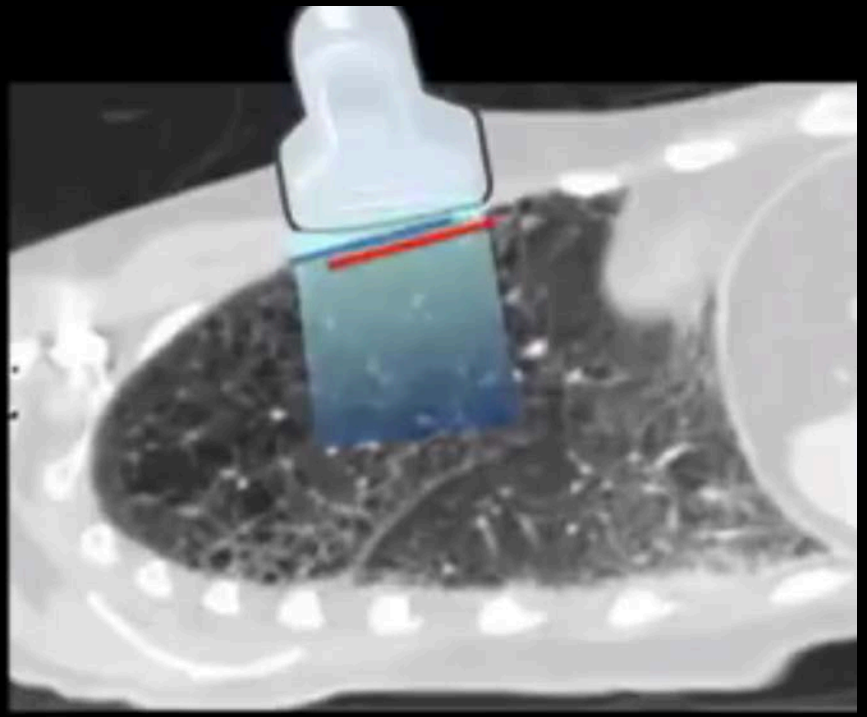


http://westernsono.ca/tutorials-3/lung-ultrasound-image-interpretation-tutorial

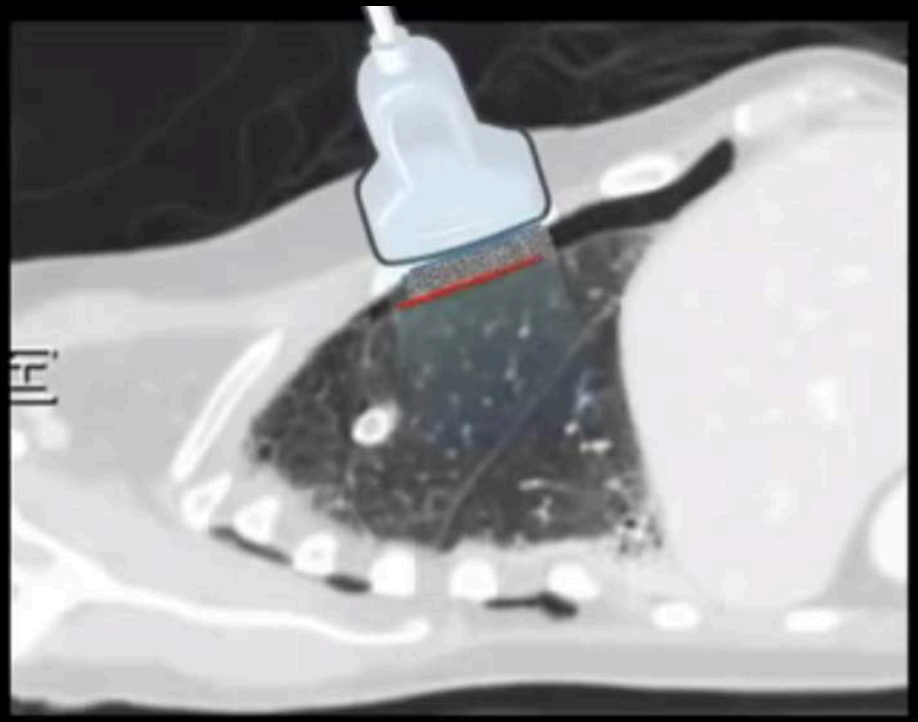
Thoracic Ultrasound:

Lung Sliding:

Present?



Absent



http://westernsono.ca/tutorials-3/lung-ultrasound-image-interpretation-tutorial

Thoracic Ultrasound:

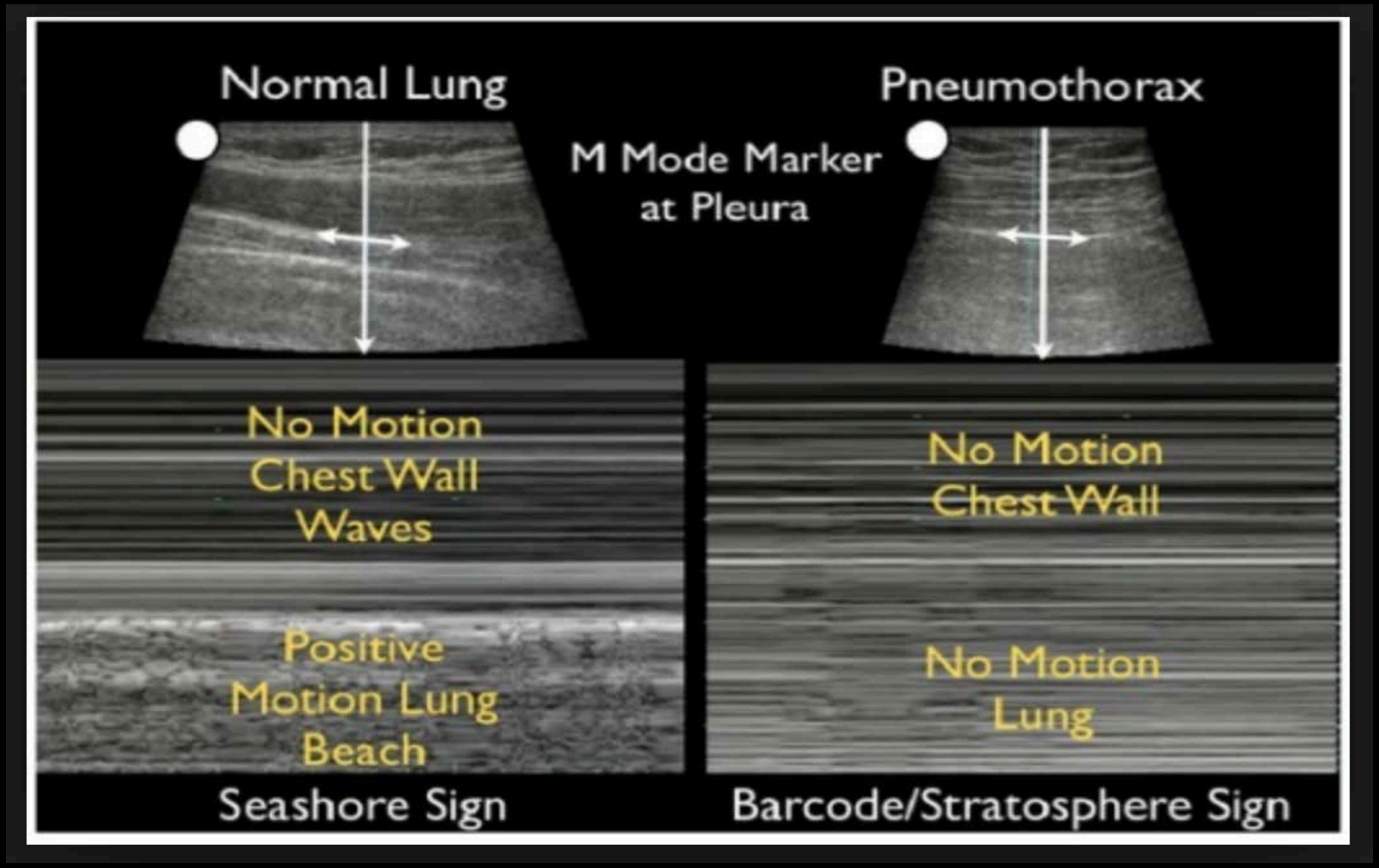
Lung Sliding, B-mode:

Thoracic Ultrasound:

Absent Lung Sliding, B-mode:

Thoracic Ultrasound:

Lung Sliding (B-mode/M-mode)



http://www.acep.org/

Thoracic Ultrasound:

Absent *Lung Sliding:*

Other causes:

- Pleural adhesion
- Atelectasis
- Lobectomy/Pneumonectomy
- Main-stem intubation

- Compare with other lung
- Look for "Lung Point" (100% specific for pneumothorax)

Thoracic Ultrasound:

"Lung Point"

Thoracic Ultrasound:

A Lines:

- Horizontal "reverberation" artifacts
- Generally seen in Aerated Lungs
- Parallel to the pleural line
- Decay with increasing depth
- Obliterated by B Lines

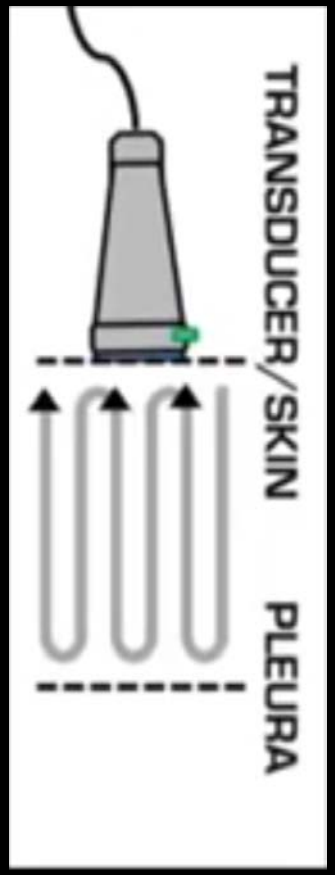
Thoracic Ultrasound:

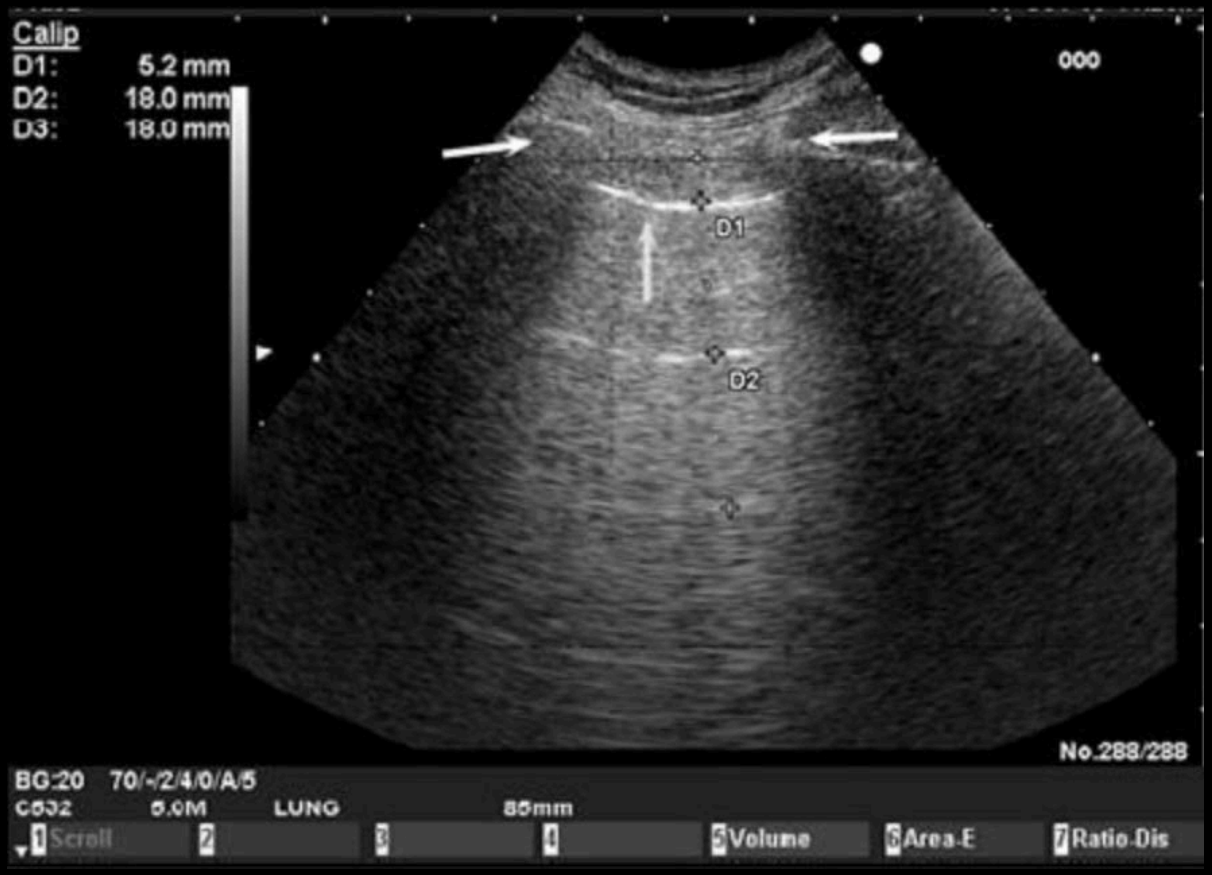
A Lines:

- Seen in normal lung parenchyma
  - P_AOP < 13 mmHg
- DD(x):
  - Obstructive Lung Disease (COPD/Asthma)
  - Pulmonary Embolism
- *A Lines* can be seen without lung sliding
  - search for pneumothorax

Thoracic Ultrasound:

A Lines:





http://www.pneumon.org

Thoracic Ultrasound:

A Lines:

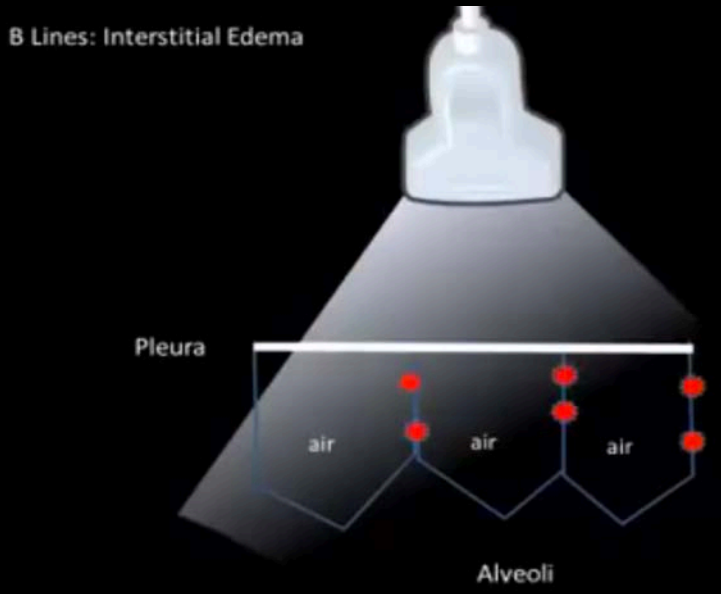
Thoracic Ultrasound:

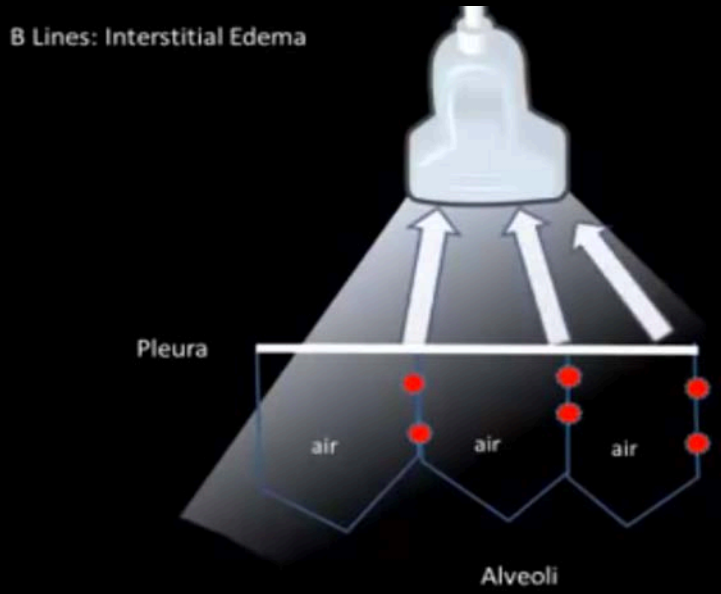
B Lines:

- Hyperechoic rays projecting vertically from pleural line to bottom of screen
  - Obliterate *A Lines*
- Identifies fluid in interlobular septum
- "Interstitial" Syndrome
  - Bilateral
    - CHF, ARDS, ILD
  - Unilateral
    - Pneumonia

Thoracic Ultrasound:

B Lines:

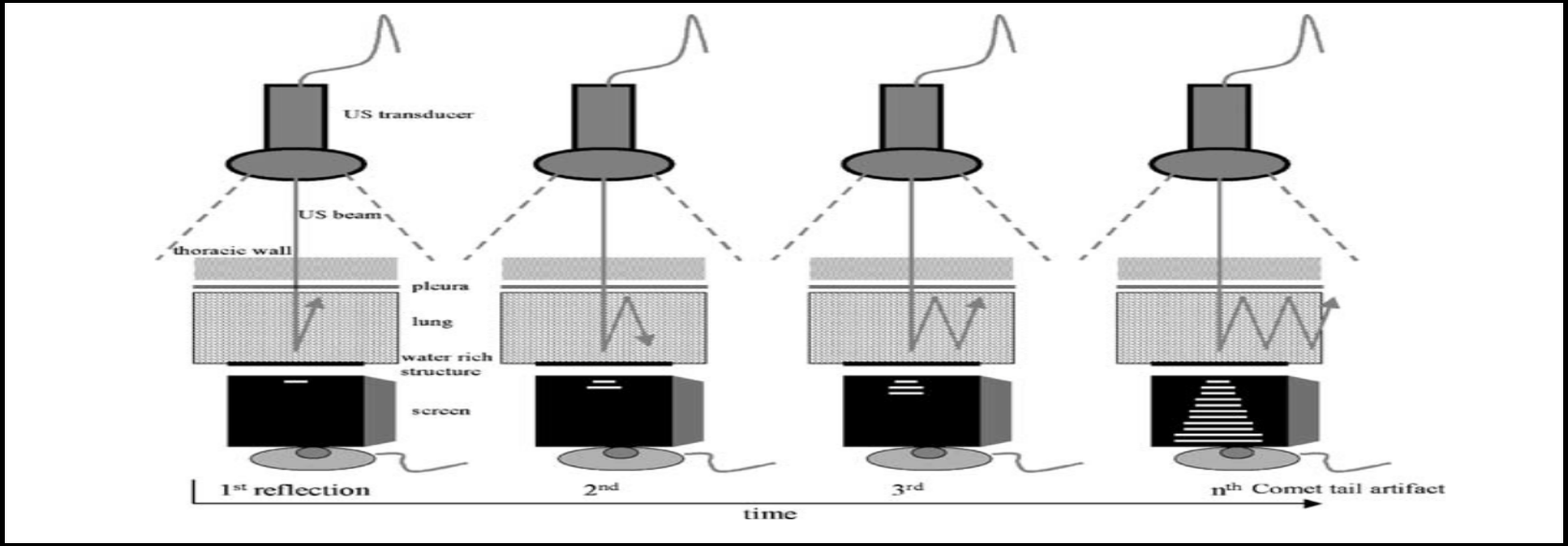




http://westernsono.ca/tutorials-3/lung-ultrasound-image-interpretation-tutorial

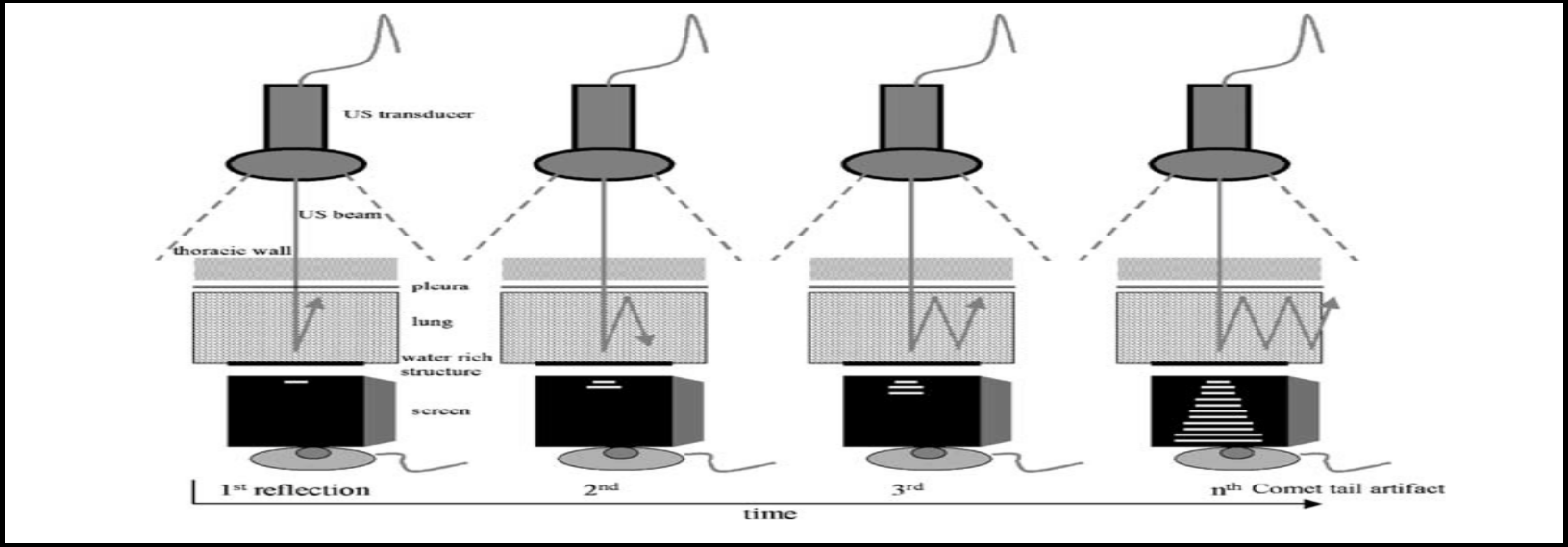
Thoracic Ultrasound:

B Lines:



Thoracic Ultrasound:

B Lines:



Thoracic Ultrasound:

B Lines:

Thoracic Ultrasound

B Lines:

Clinical Role of *B Lines:*

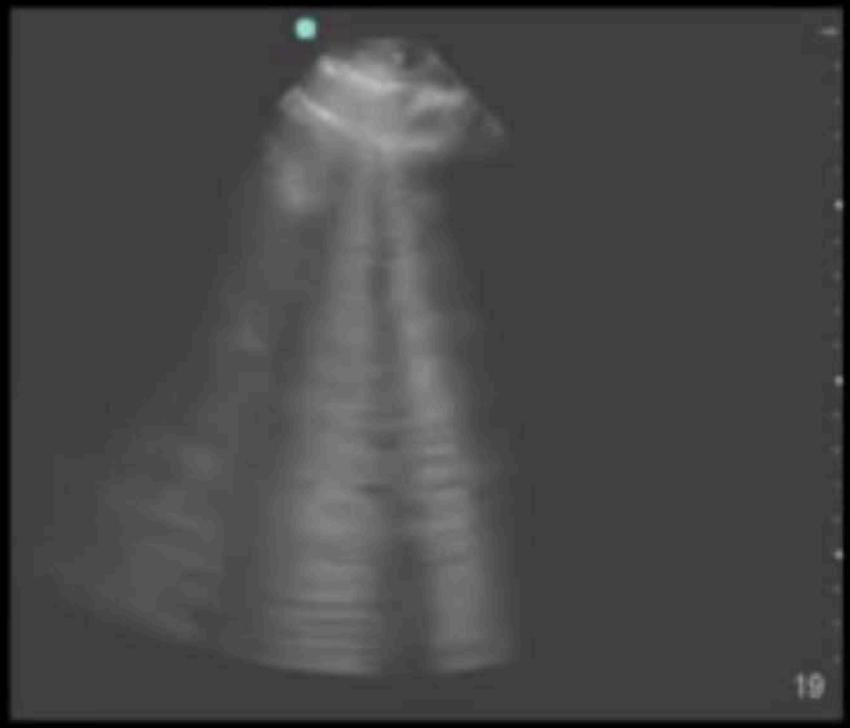
Fluid "Intolerant"

vs

Fluid "Tolerant"

Thoracic Ultrasound:

A Lines vs B Lines:



http://www.scielo.br/scielo

Thoracic Ultrasound:

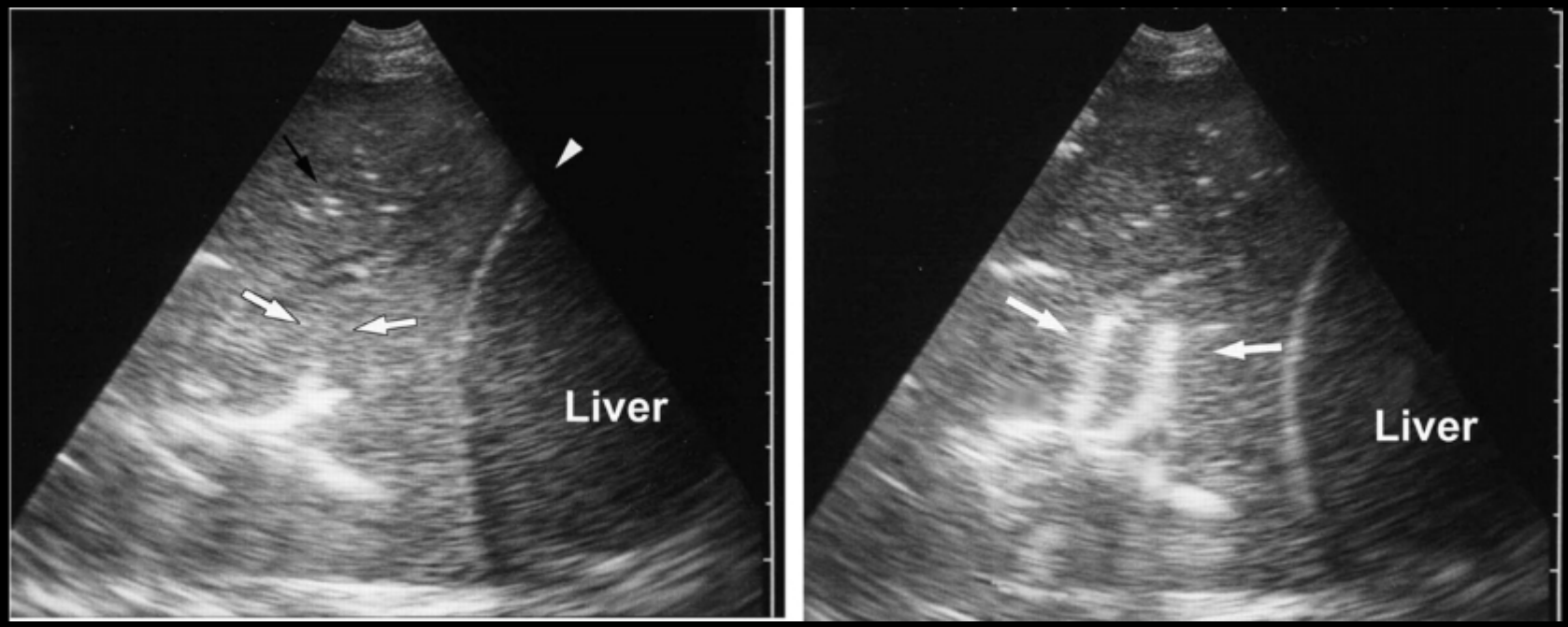
Consolidation:

http://westernsono.ca/tutorials-3/lung-ultrasound-image-interpretation-tutorial

Thoracic Ultrasound:

Consolidation:

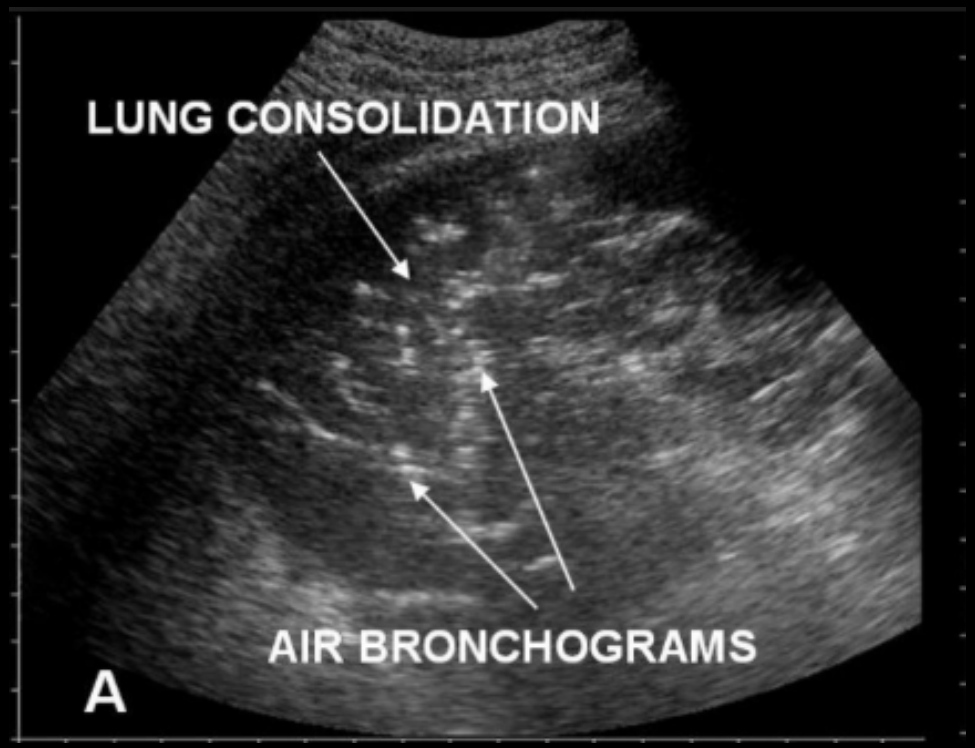
Air bronchograms



Chest. 2009;135(6):1421-1425

Thoracic Ultrasound:

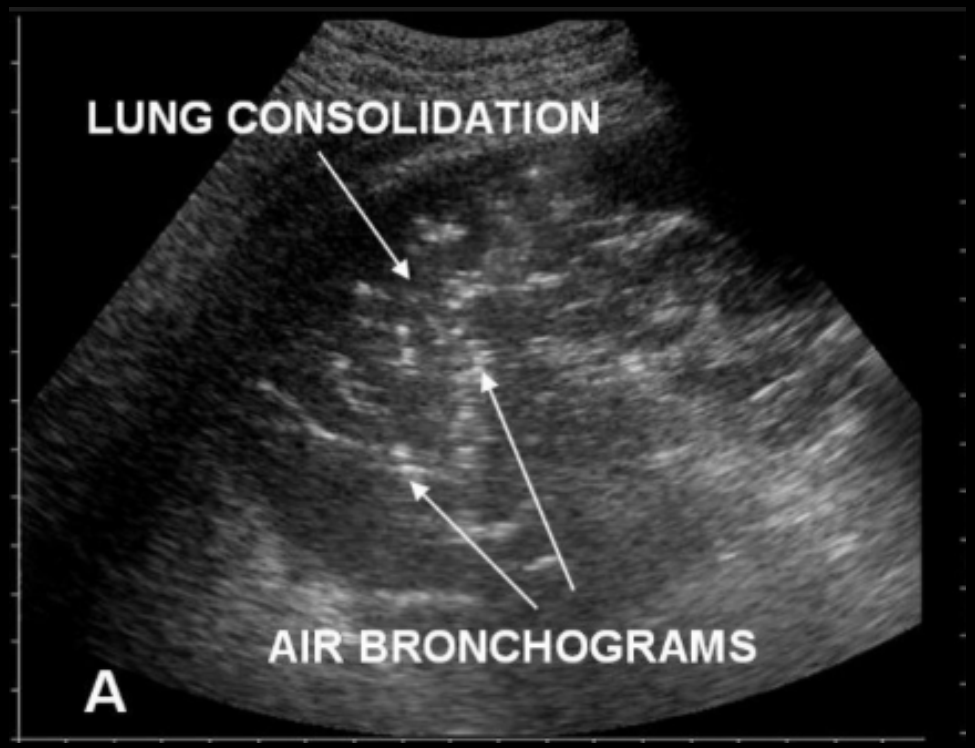
Consolidation:

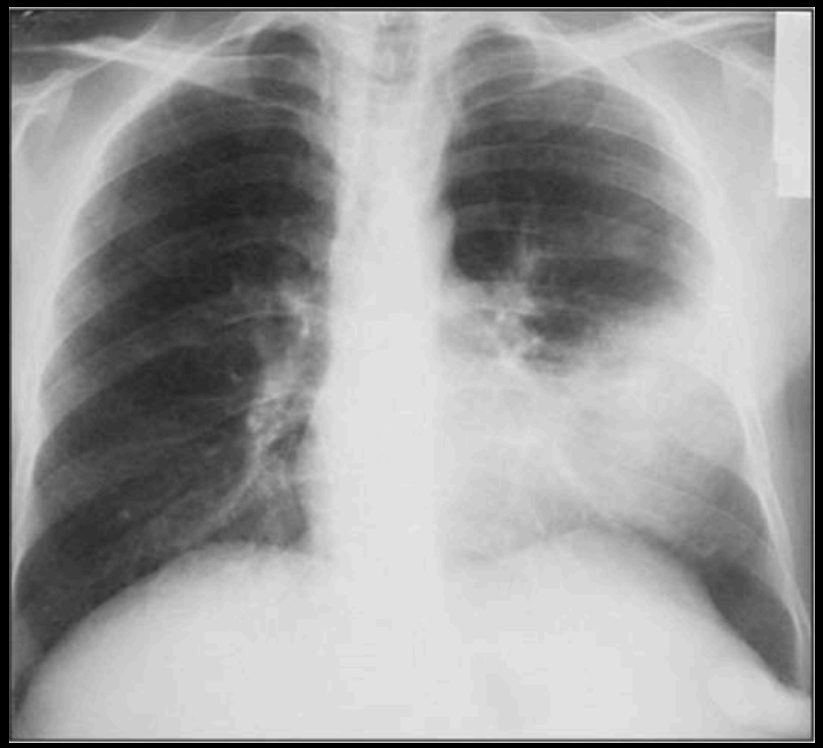


http://www.criticalecho.com/content/tutorial-9-lung-ultrasound

Thoracic Ultrasound:

Consolidation:





http://www.criticalecho.com/content/tutorial-9-lung-ultrasound

Thoracic Ultrasound:

Pleural Effusion:

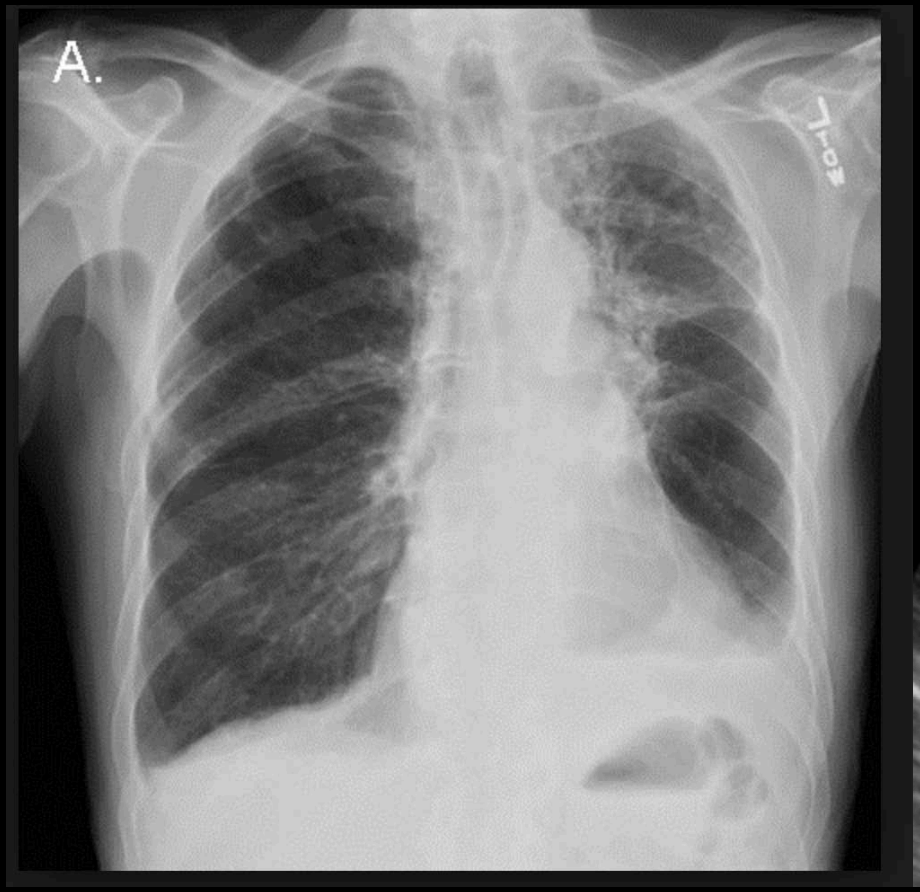
http://westernsono.ca/tutorials-3/lung-ultrasound-image-interpretation-tutorial

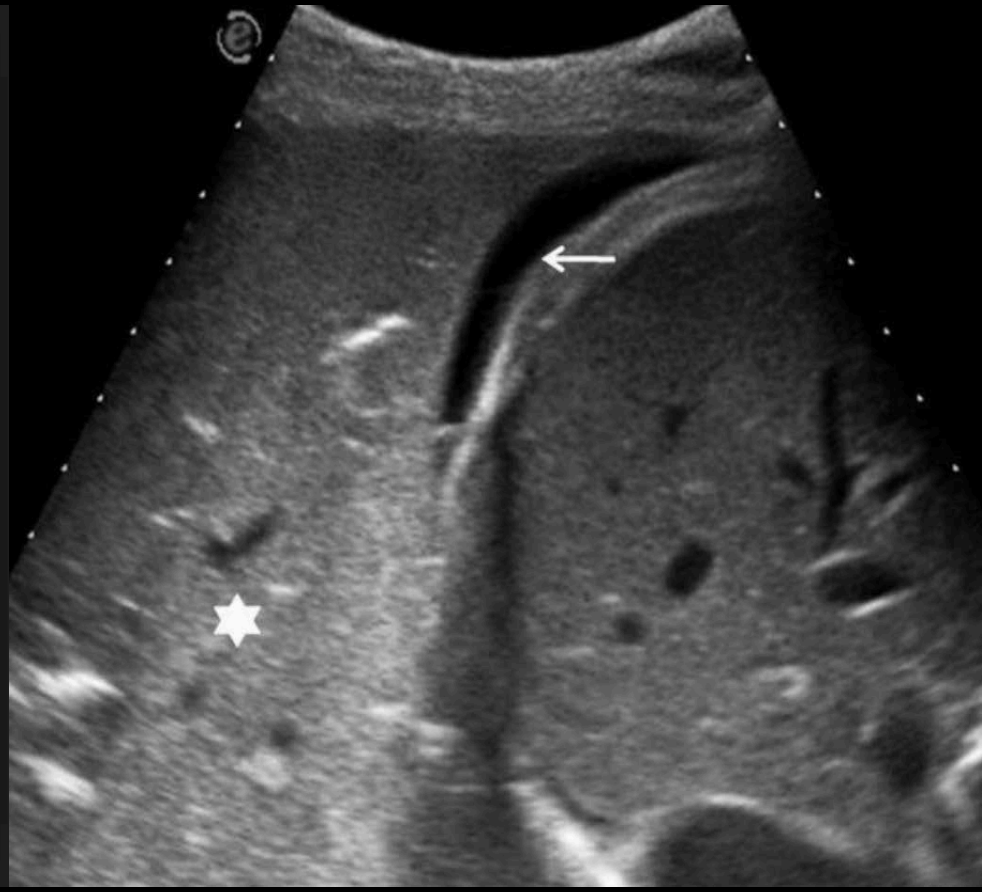
Thoracic Ultrasound:

Pleural Effusion:

Thoracic Ultrasound:

Pleural Effusion:

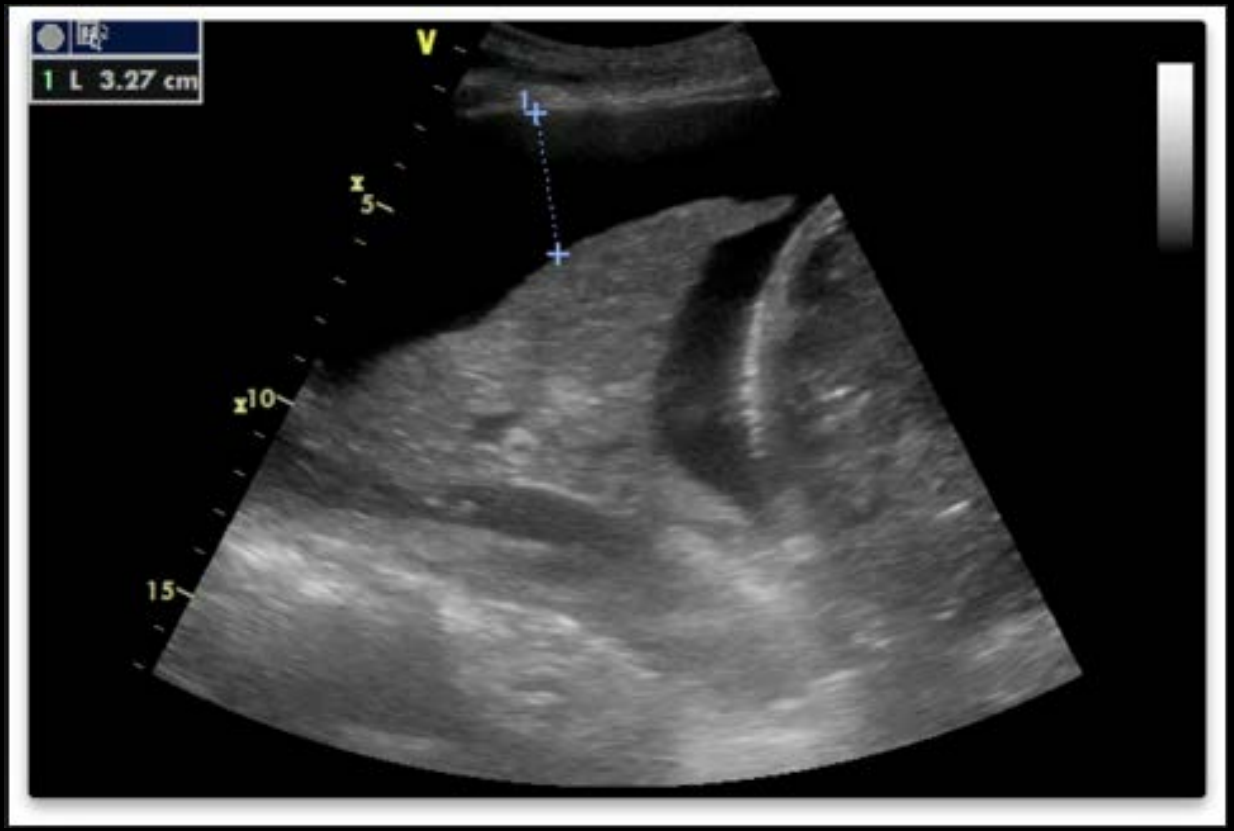




Thoracic Ultrasound:

Pleural Effusion:

"Jelly Fish" sign



Thoracic Ultrasound:

Pleural Effusion:

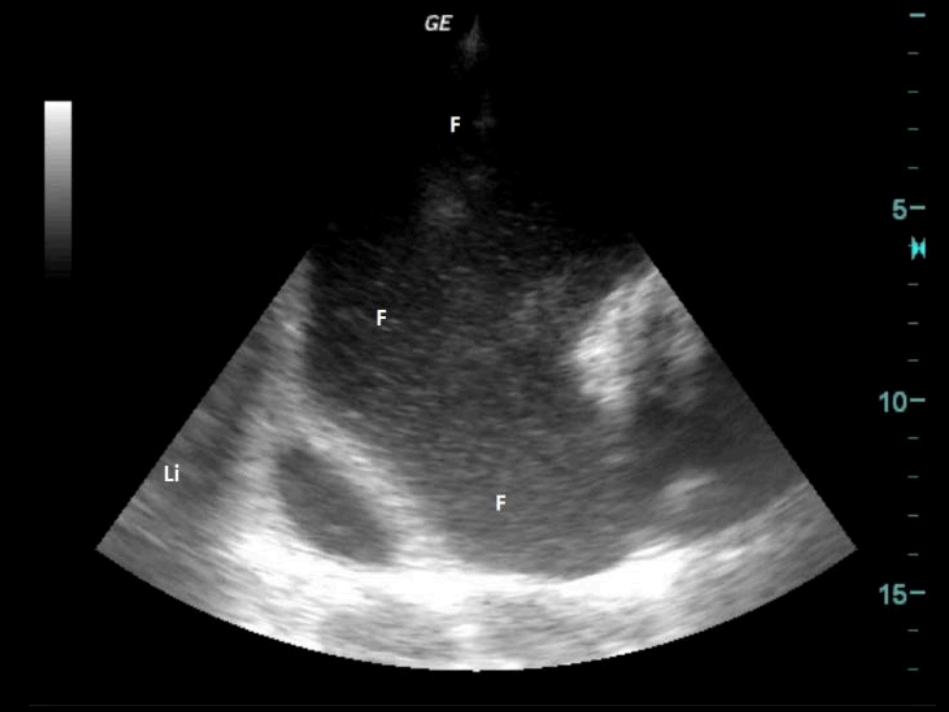
"Jelly Fish" sign / Lung Flapping

Thoracic Ultrasound:

Pleural Effusion:

Septations

"Plankton" sign



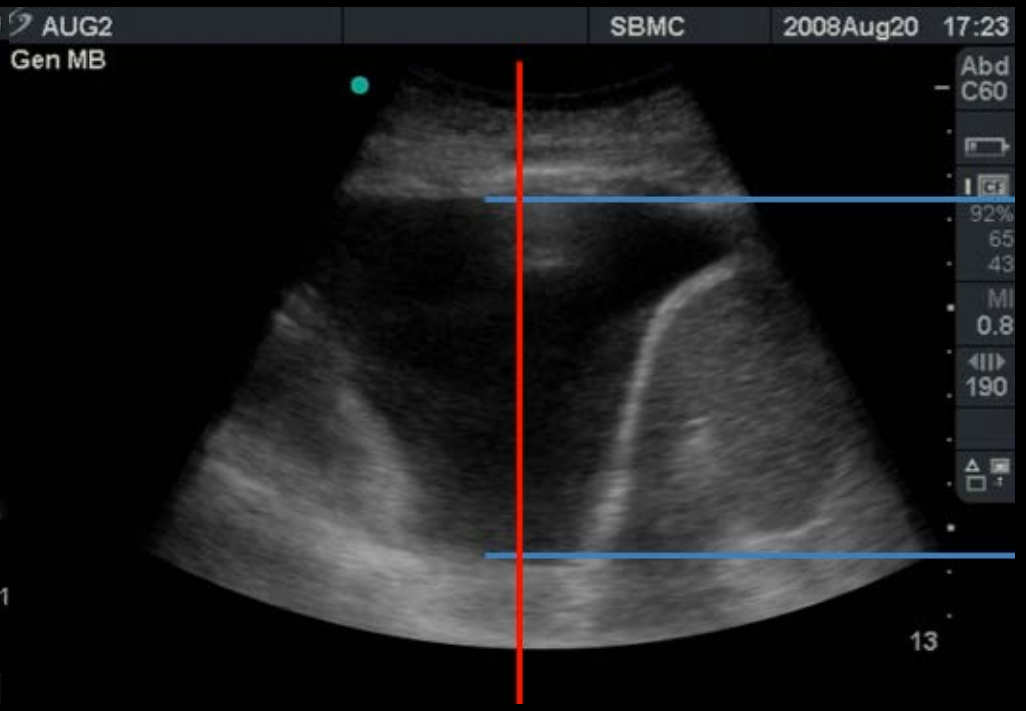
Thoracic Ultrasound:

Thoracentesis:

Thoracic Ultrasound:

Thoracentesis:

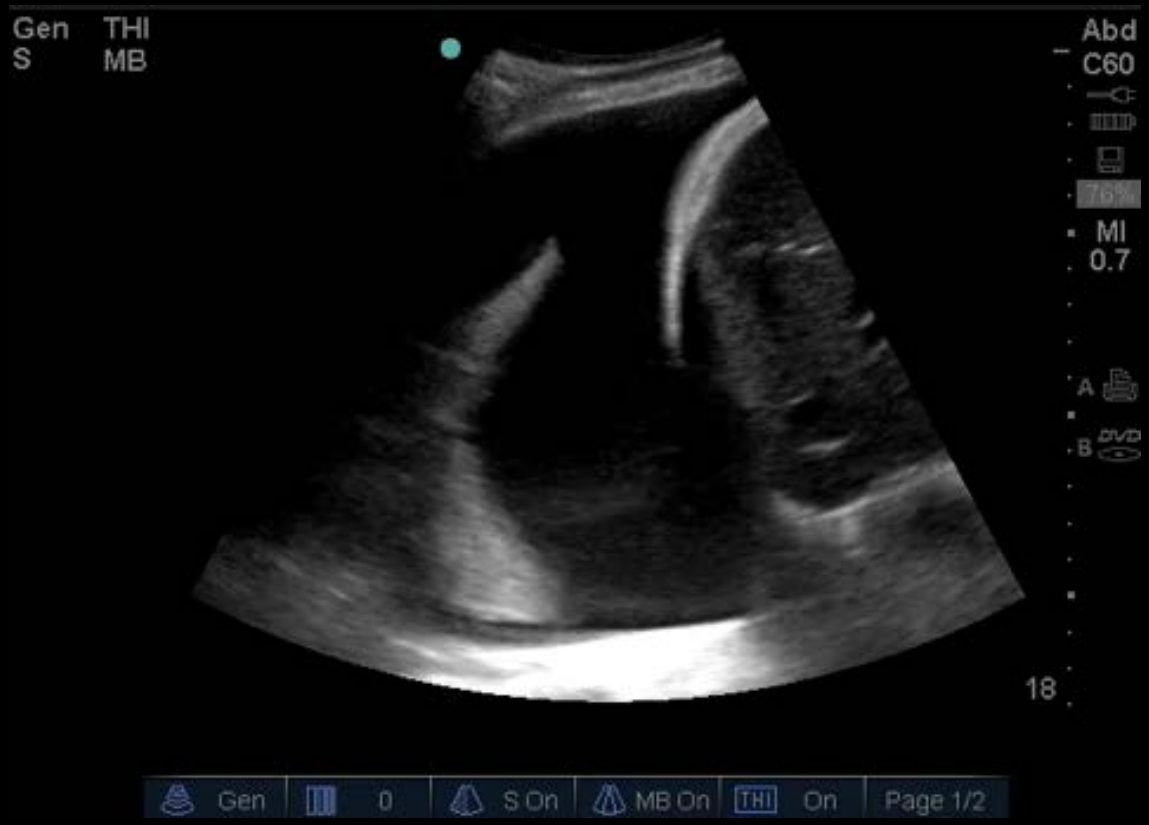
Localize deepest "pocket" of fluid in longitudinal and transverse plane



http://www.clevelandclinicmeded.com/medicalpubs/diseasemanagement/pulmonary/bedside-applications-of-ultrasound/

Thoracic Ultrasound:

Thoracentesis:



Must Identify:

- Anechoic free space
- Chest wall
- Diaphragm
  - Above vs below
  - Respiratory Movement
- Compressed Lung
  - "Flapping"

http://link.springer.com/referenceworkentry

Thoracic Ultrasound:

Thoracentesis:

"Static" Guidance

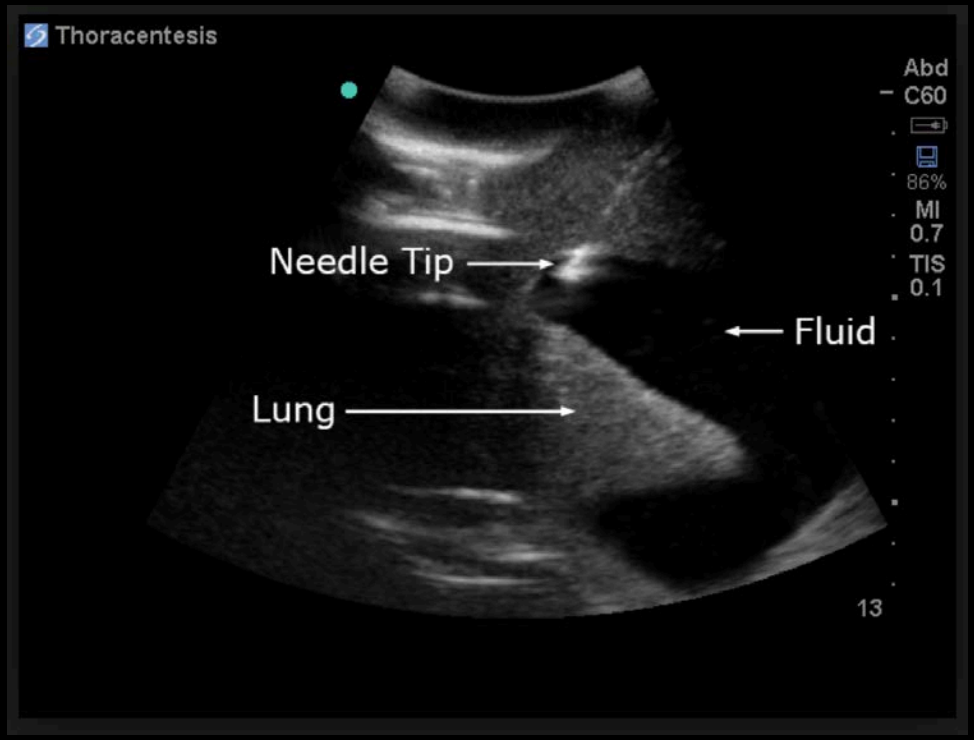
"Dynamic" Guidance

Thoracic Ultrasound:

Thoracentesis:

"Static" Guidance

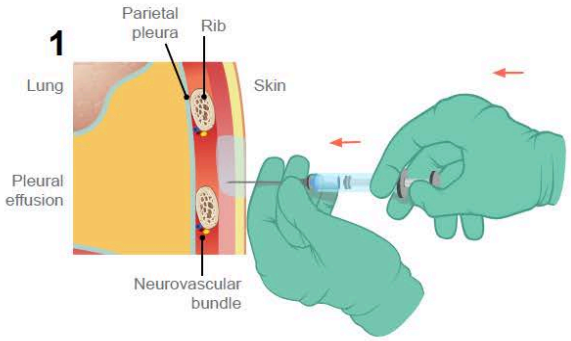
"Dynamic" Guidance



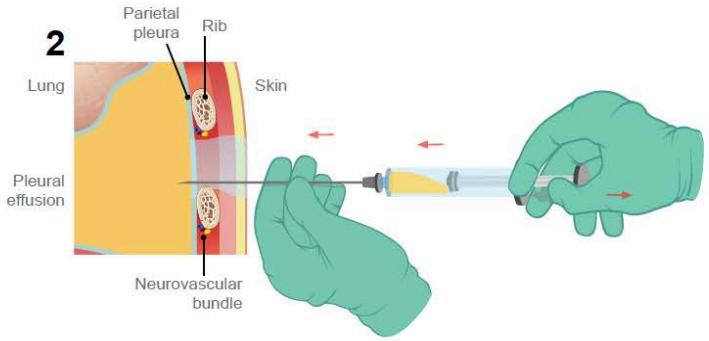
http://www.pocustoronto.com/articulate/thora/story.html

Thoracic Ultrasound:

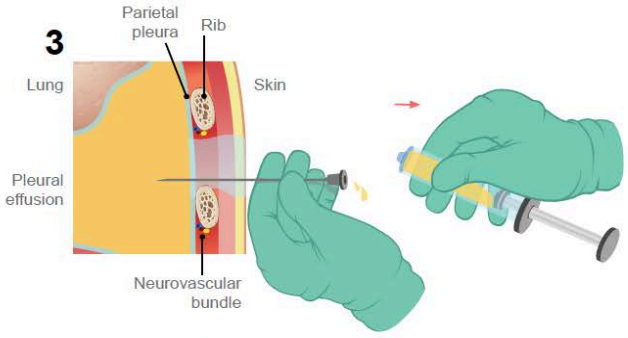
Thoracentesis:



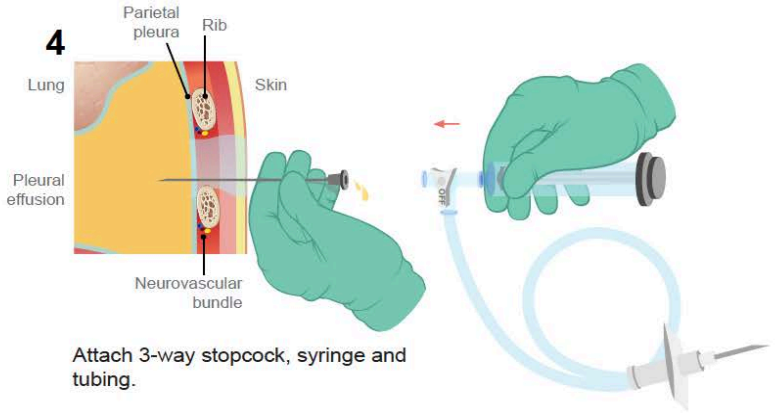
Local anesthetic is used. Note that the needle should not be advanced beyond the distance from the skin to the chest cavity as demonstrated on ultrasound.



Insert needle while simultaneously aspirating on syringe. Note the needle should not be advanced more than the distance to the pleural fluid as demonstrated on ultrasound.



Remove syringe.

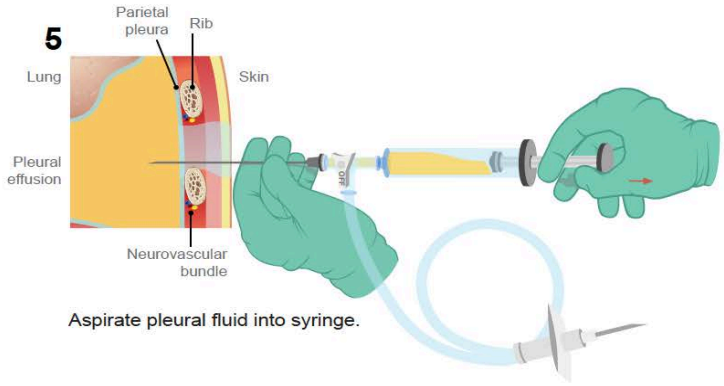


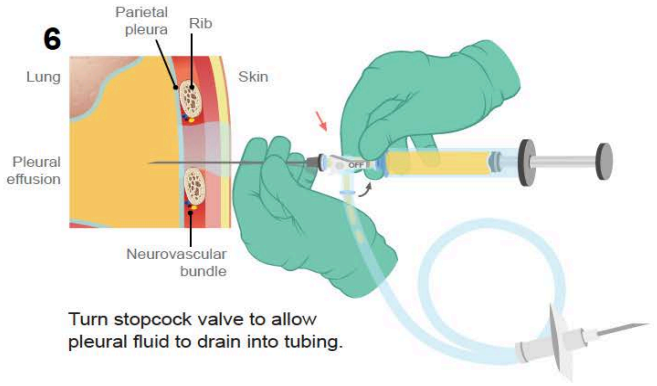
Attach 3-way stopcock, syringe and tubing.

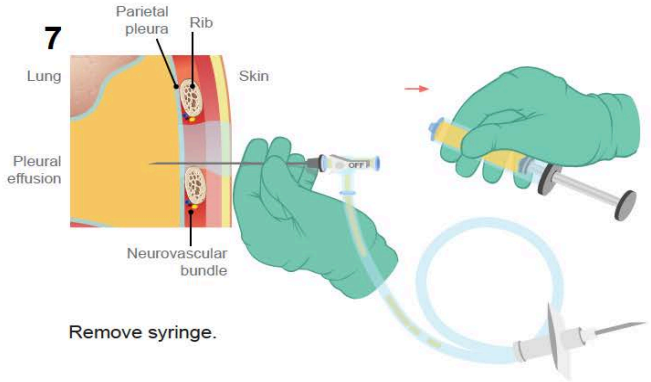
http://www.med.uottawa.ca/courses/

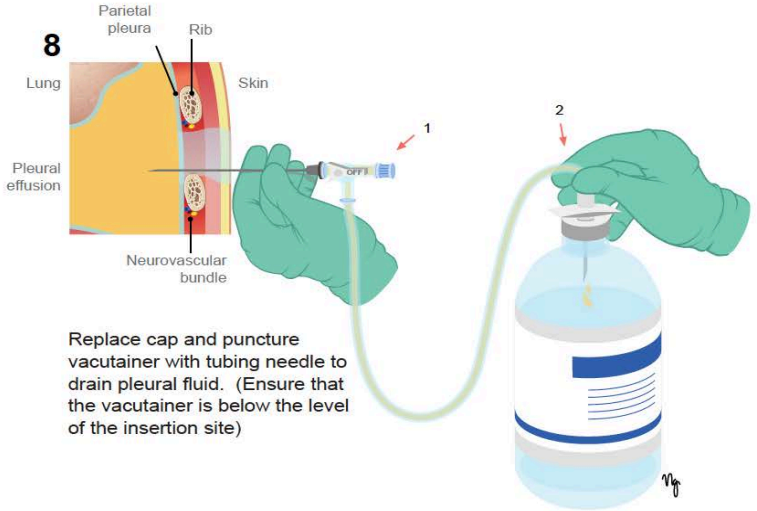
Thoracic Ultrasound:

Thoracentesis:









http://www.med.uottawa.ca/courses/

Thoracic Ultrasound:

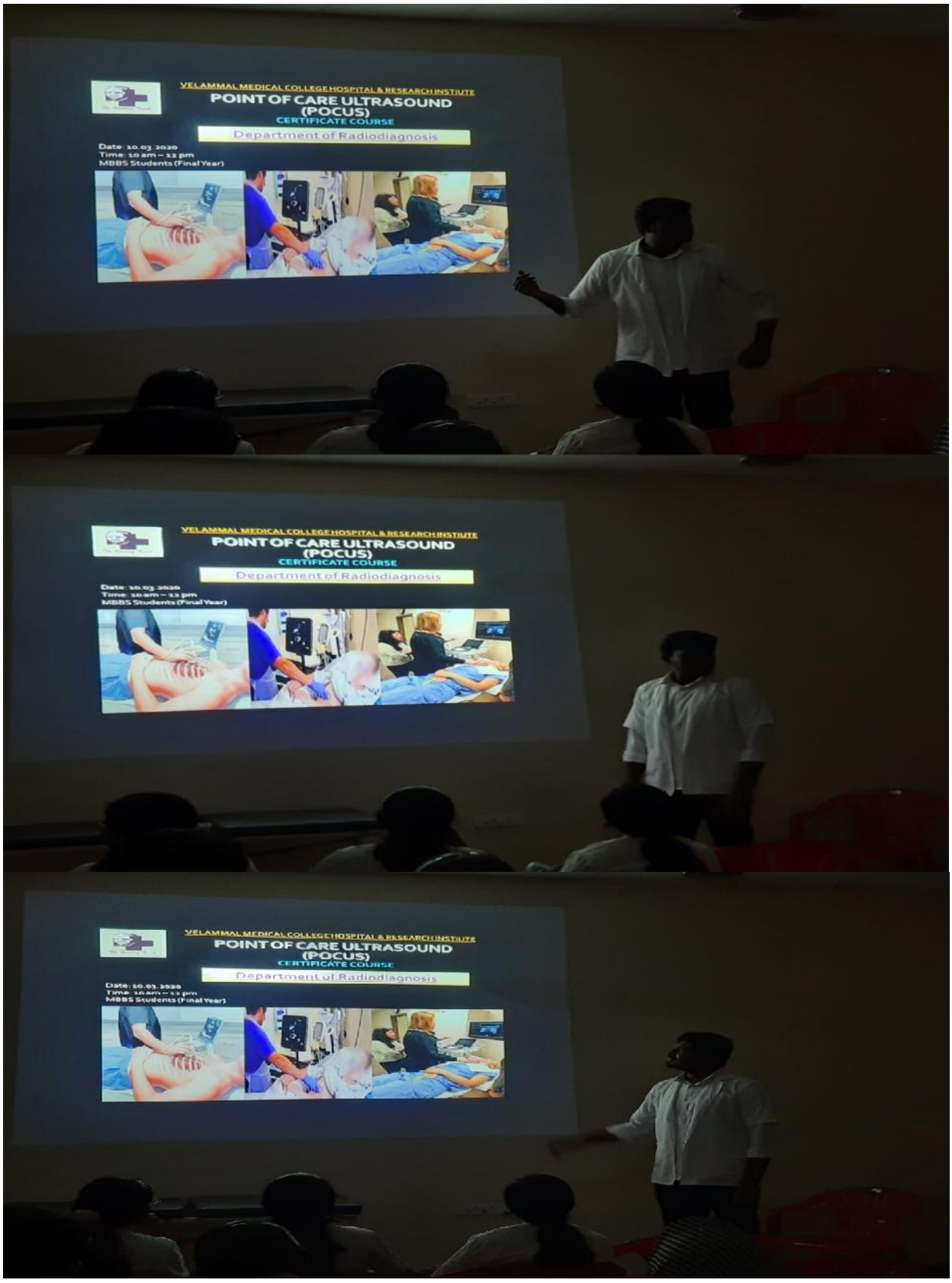
Thoracentesis:

Pearls & Pitfalls:

- Identify anatomic boundaries:
  - Anechoic free space
  - Chest wall
  - Diaphragm
    - Diaphragm movement?
  - Compressed lung
    - Lung flapping?
- R/O ascites:
  - Hepatorenal/splenorenal space vs pleural space?


POINT OF CARE ULTRASOUND
(POCUS)


VELAMMAL MEDICAL COLLEGE HOSPITAL & RESEARCH INSTITUTE
POINT OF CARE ULTRASOUND
(POCUS)
CERTIFICATE COURSE


VELAMMAL MEDICAL COLLEGE HOSPITAL & RESEARCH INSTIUTE
POINT OF CARE ULTRASOUND
(POCUS)
CERTIFICATE COURSE
Department of Radiodiagnosis
Date: 10.03.2020
Time: 10 am – 12 pm
MBBS Students (Final Year)
VELAMMAL MEDICAL COLLEGE HOSPITAL & RESEARCH INSTIUTE
POINT OF CARE ULTRASOUND
(POCUS)
CERTIFICATE COURSE
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MBBS Students (Final Year)


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VELAMMAL MEDICAL COLLEGE
HOSPITAL & RESEARCH INSTITUTE

DEPARTMENT OF RADIODIAGNOSIS

IMAGING OF PELVIS

CERTIFICATE COURSE

VELAMMAL MEDICAL COLLEGE HOSPITAL & RESEARCH INSTIUTE

IMAGING OF PELVIS

CERTIFICATE COURSE

Department of Radiodiagnosis

Date: 15.07.2020
Time: 10 am – 12 pm

Radiology Post Graduates
Bsc Radiology & Imaging Technology Students

DEPARTMENT OF RADIODIAGNOSIS
CERTIFICATE COURSE –IMAGING OF PELVIS
15.07.2020

S.No	Name	Mobile Number	Signature
1.	P. Kavya	8883645494	P Kavya
2.	Kavyasree A K.	[illegible]	[illegible]
3.	S. Karigha	9894192860	S. Karigha
4.	S. Hariharan	[illegible]	[illegible]
5.	Jeffy. M. Ann	9791627161	Jeffy M Ann
6.	Gopika. M	9087457498	Gopika
7.	INDUJA. M.S.	8778264824	Induja
8	M Jafira Banu.	9698110999	M Jafi
9.	K. Pooja	8247866911	Pooja.
10.	K.R. KAVITHA	9840789627	K.R. Kavitha
11	Krishna Priya	8848518799	[illegible]
12.	GOPIKA P	9952313917	[illegible]
13.	KAVYA E	7094925138	[illegible]

CT and MRI of Female Pelvis

- **Imaging of female pelvis plays a critical role in diagnosis of various gynecological diseases.**
- **USG is used as first line of evaluation of female genital organs.**
- **CT and MRI are preferred for evaluation of benign and malignant gynecological diseases.**
- **Including staging of cancers , monitoring the response of therapy , surveillance in treated malignancies , surgical planning , and assessment of patients with acute pelvis pane in an emergency settings**

VAGINA

- **H shaped configuration on Transaxial images and consists of fibromuscular tube extending upward and backward from vulva to uterus.**
- **Upper third of vagina is corresponds to Lateral vaginal fornices ,and is supported by levator ani , transverse cervical , pubocervical and sacrocervical.**
- **Middle third vagina corresponds to LEVEL OF BLADDER BASE (which is *supported by urogenital diaphragm)***
- **Lower third corresponds at level od urethra(supported by perineal body).**

Lymphatic drainage : upper third into external and internal iliac nodes, middle third into internal iliac nodes and lower third into superficial inguinal lymphnodes.

Venous drainage into internal iliac vein.

IMAGING CHARACTERISTICS

MRI – normal vaginal mucosal folds T2 hyperintense , T1 hypointense.

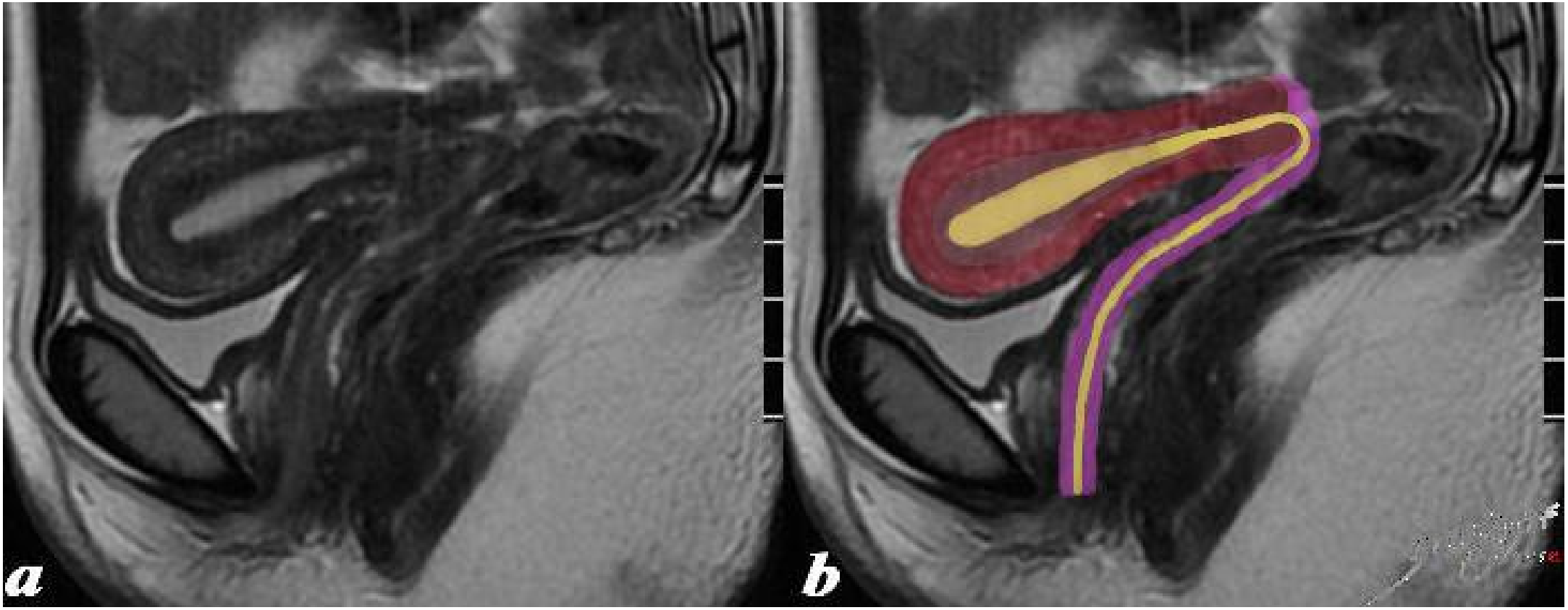
Its is lined by estrogen sensitive stratified squamous epithelium and endoluminal mucous.

Submucosa and muscularis layer – T1, T2 hypointense

Outer adventitial layer – T2 hyperintense (serpentine due to vaginal venous plexus slow)

MUCOSAL layer is thicker and higher T2 weighted signal –LATE PROLIFERATIVE PHASE

MUCOSAL layer is thin and lower T2 weighted signal - before MENARCHE and MENOPAUSE.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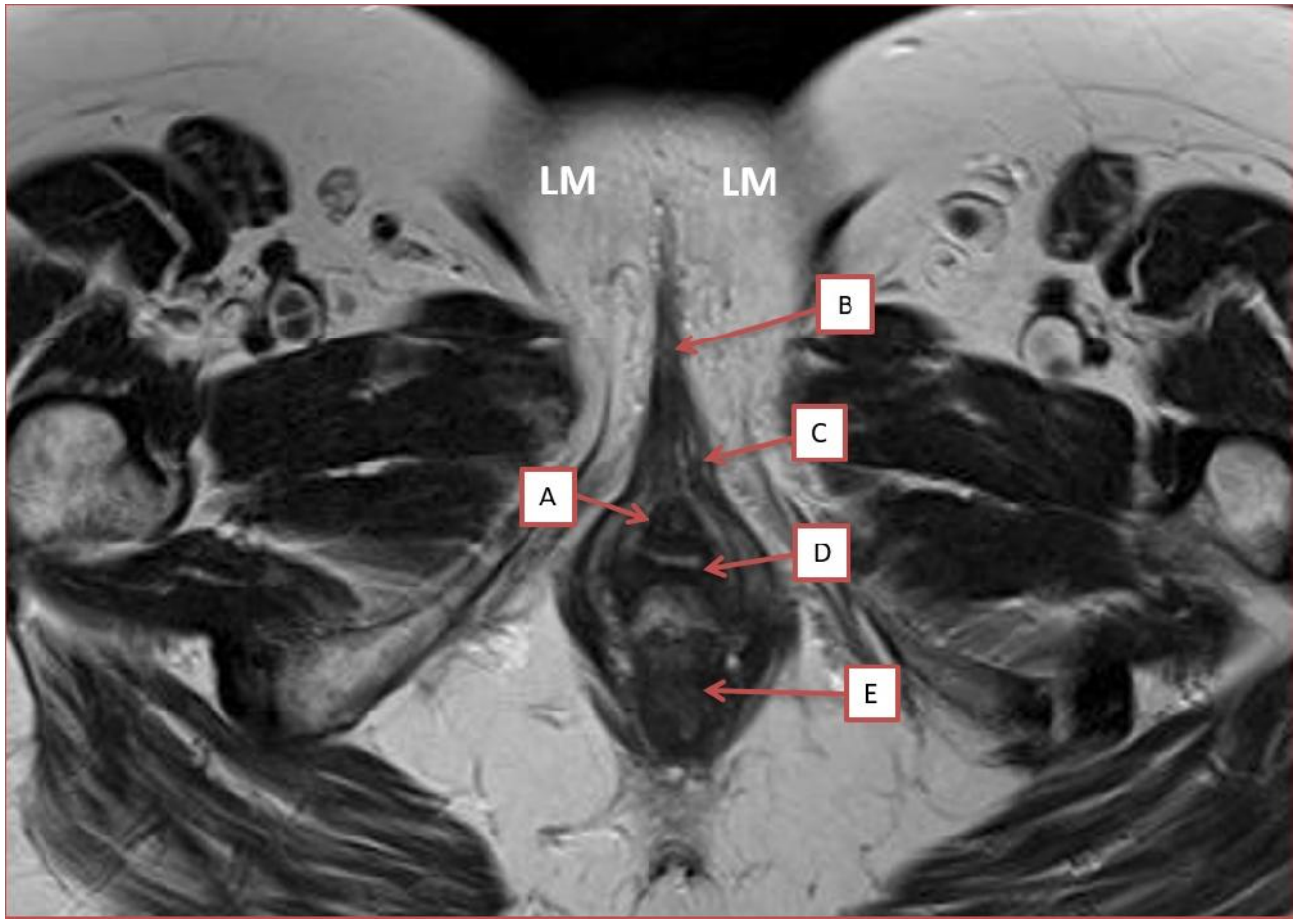
VULVA

- **Is composed of mons pubis , labia majora , minora, clitoris , vestibular bulb , vestibular glands , vestibule of vagina.**
- **Artery supply – branches of external and internal pudendal arteries.**
- **Lymphatic drainage – medial group of superficial inguinal lymphnodes.**

IMAGING – low to intermediate signal intensity on T1 weighted imaging and slightly higher signal in T2 weighted imaging.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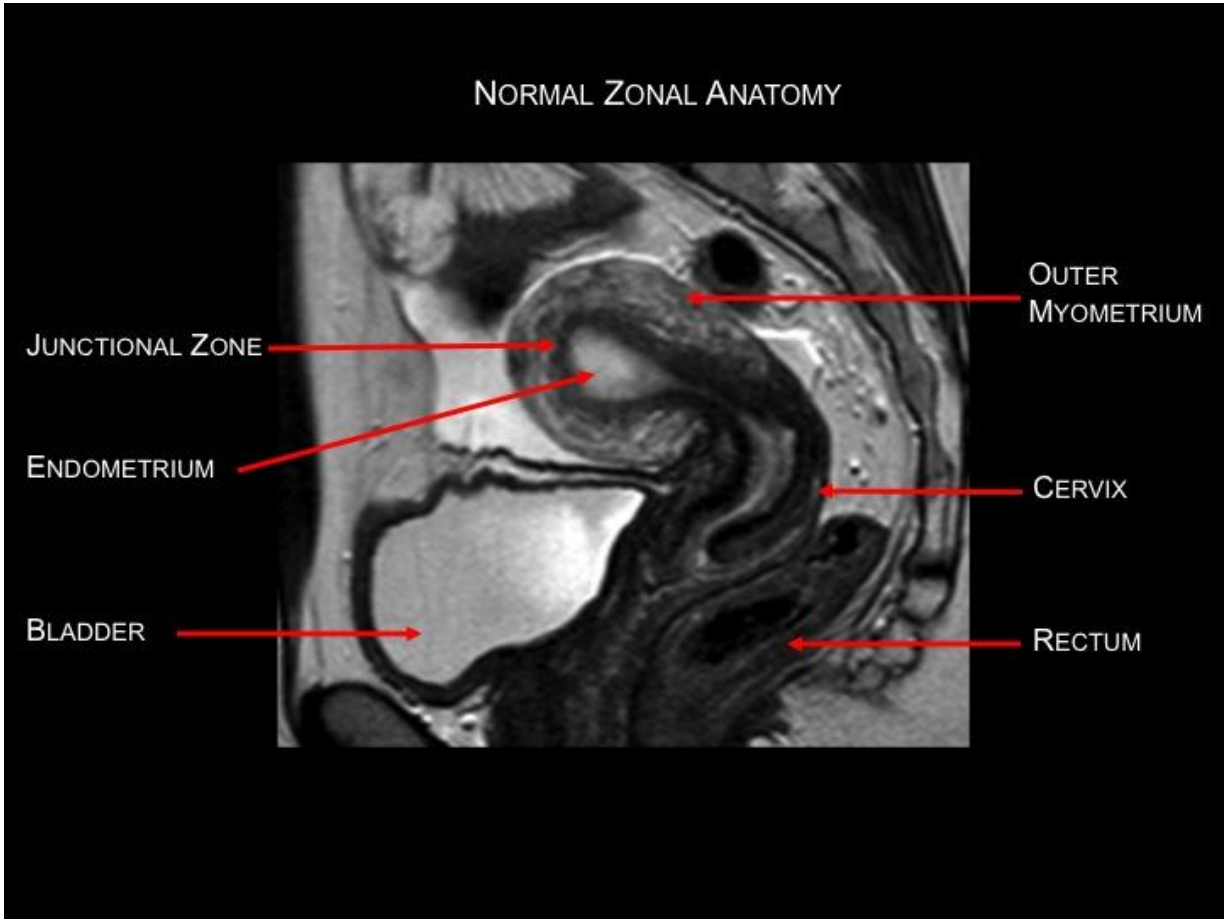
UTERUS

- **Divided into – fundus , body (uterine corpus), cervix**
- **Uterine body is made up of 3 layers – endometrium (inner lining) , myometrium (muscular wall) and serosa (outer layer)**
- **Normal thickness of endometrium varies during the phase of menstrual cycle- greatest at midsecretory phase.**
- **In post menopausal women – max upto 5mm and can be upto 8 mm if she is under hormone replacement therapy.**
- **Deep to the endometrium is a band of lowT2 signal intensity known as JUNCTIONAL ZONE which is formed by inner third of myometrium.**
- **Tissue of outer two thirds of myometrium demonstrate Intermediate signal on T2 imaging.**


NORMAL ZONAL ANATOMY
OUTER MYOMETRIUM
JUNCTIONAL ZONE
ENDOMETRIUM
CERVIX
BLADDER
RECTUM

CERVIX

Separated from uterine body by internal OS at the level of entrance of uterine vessels.

Endocervical canal contains small folds called *pilicae palmatae.*

IMAGING- Dense fibromuscular stroma appears as T2 hypointense homogenously.

Uterus is supported by round and tuboovarian ligaments and is covered by peritoneum.

Uteroovarian ligaments blends laterally to form anterior and posterior leaves of broad ligaments.

Vascular supply is from uterine arteries pass within the broad ligament to enter uterus.

Venous drainage parallels into iliac veins.

Lymphatic drainges- LOWER and MIDDLE part to parametrial, paracervical and OBTURATOR nodes

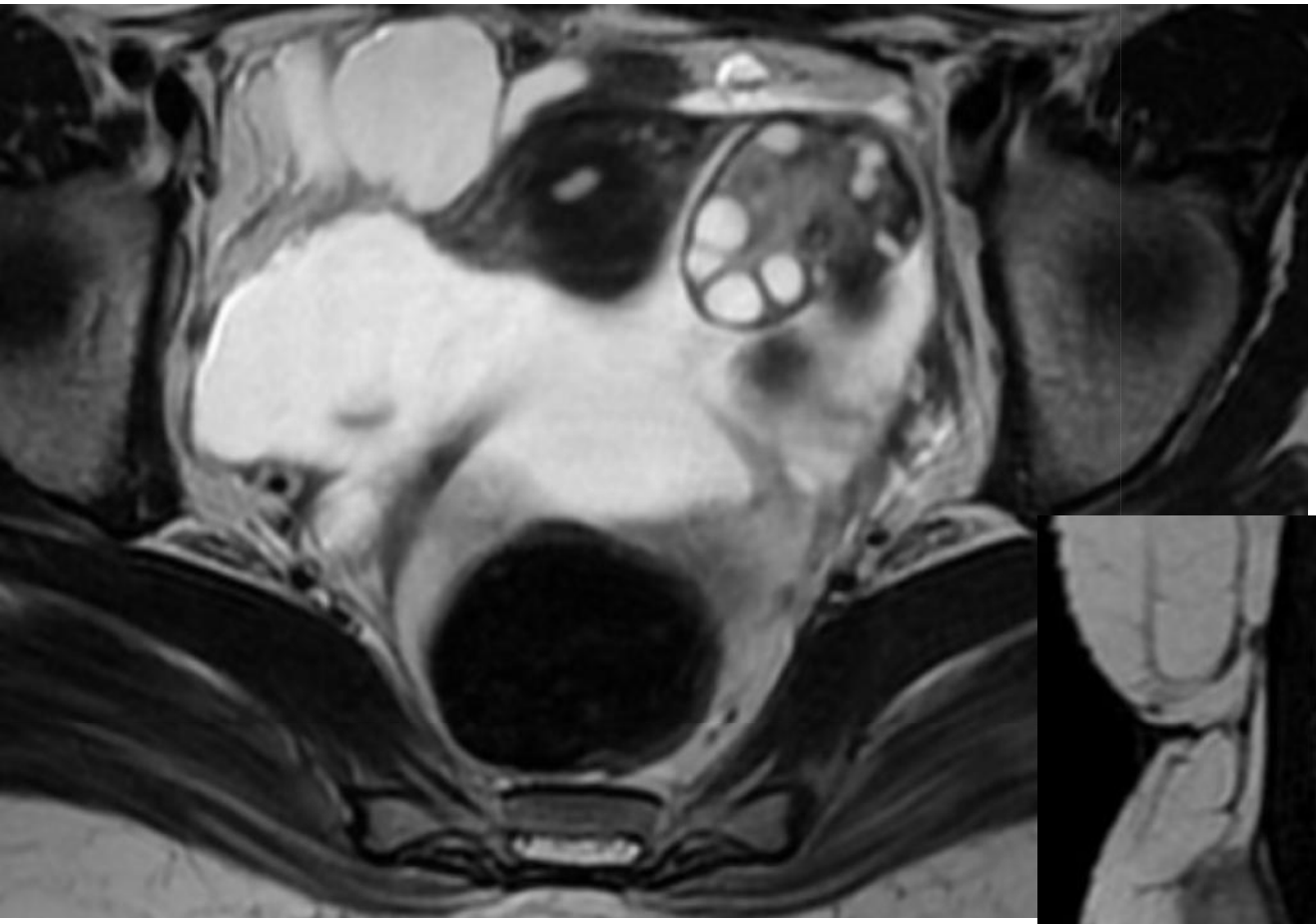
UPPER corpus and UTERINE FUNDUS into common iliac and PARAAORTIC regions.

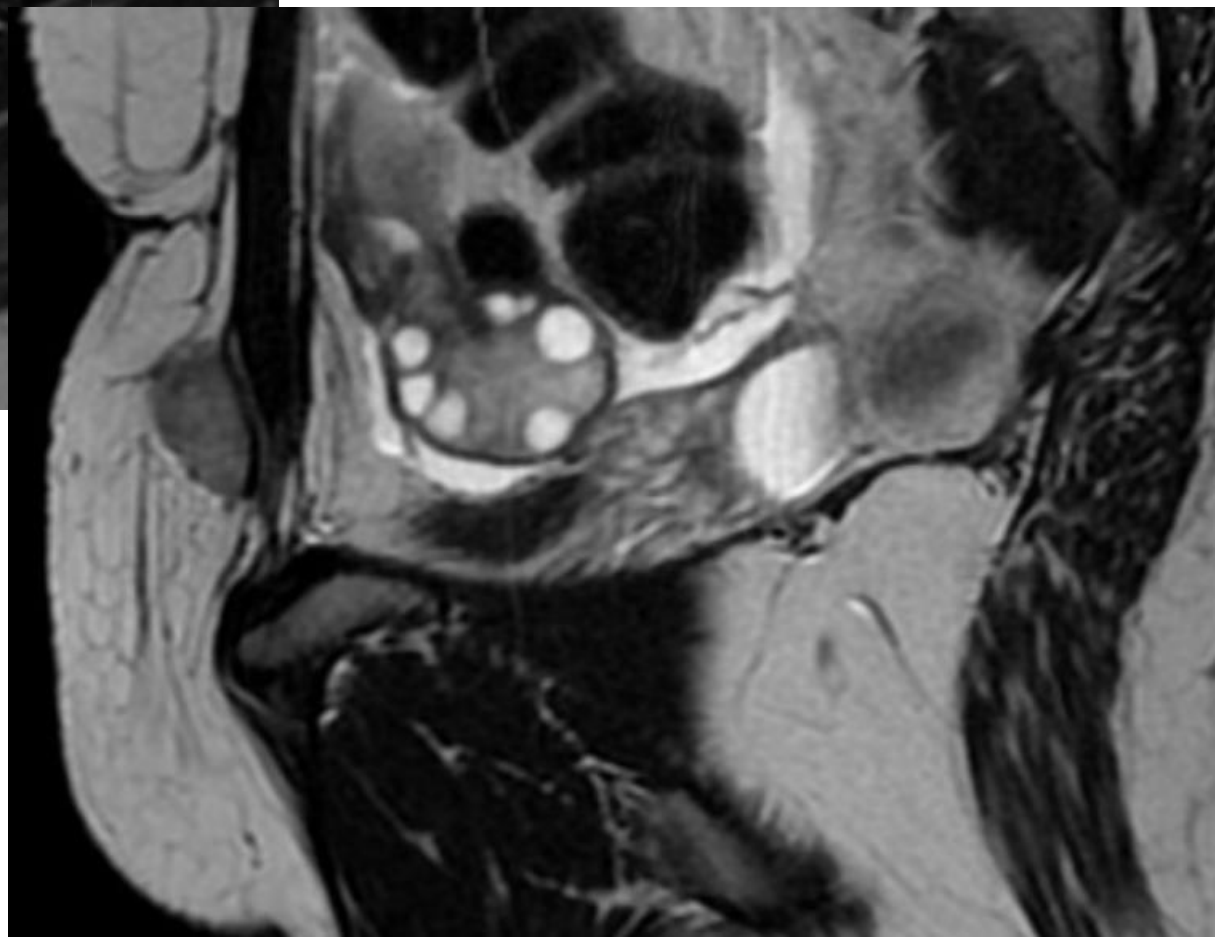
OVARY

- **Ovaries are almond shaped , whose appearance varies depending on AGE , HORMONAL INFLUENCE and PHASE OF MENSTRUAL CYCLE.**
- **Located in peritoneal depression called OVARIAN FOSSA lateral to uterus , and between external iliac and internal iliac fossa.**
- **Anchored by three structures- MESOOVARIUM ~ anchors ovary to posterior surface of broad ligament , UTEROOVARAIN LIGAMENT~ ovary to uterus and SUSPENSORY LIGAMENT ~ovary to pelvic sidewall.**
- **Uteroovarian ligament and suspensory ligament have some amount of laxity , so postion of ovary may vary.**

IMAGING

- **In women of reproductive age group , ovaries exhibit zonal anatomy on T2W images.**
- **CORTEX – lower signal intensities than the central medulla**
- **PERIPHERAL ZONE – contains multiple cysts representing the various stage of FOLLICULOGENESIS ~corpus luteal cyst , follicular cyst and surface inclusion cyst.**
- **Most cyst are THIN WALLED with LOW SIGNAL IN T1 , HIGH SIGNAL in T2 reflecting simple fluid as content.**
- **Dominant follicle may increase size upto 25 mm and after ovulation becomes corpus luteal cyst which demonstrate thick irregular avidly enhancing walls and may contain more complex fluid signal intensity.**
- **Normal PM ovaries show LOWER SIGNAL onT2 images without Follicles.**

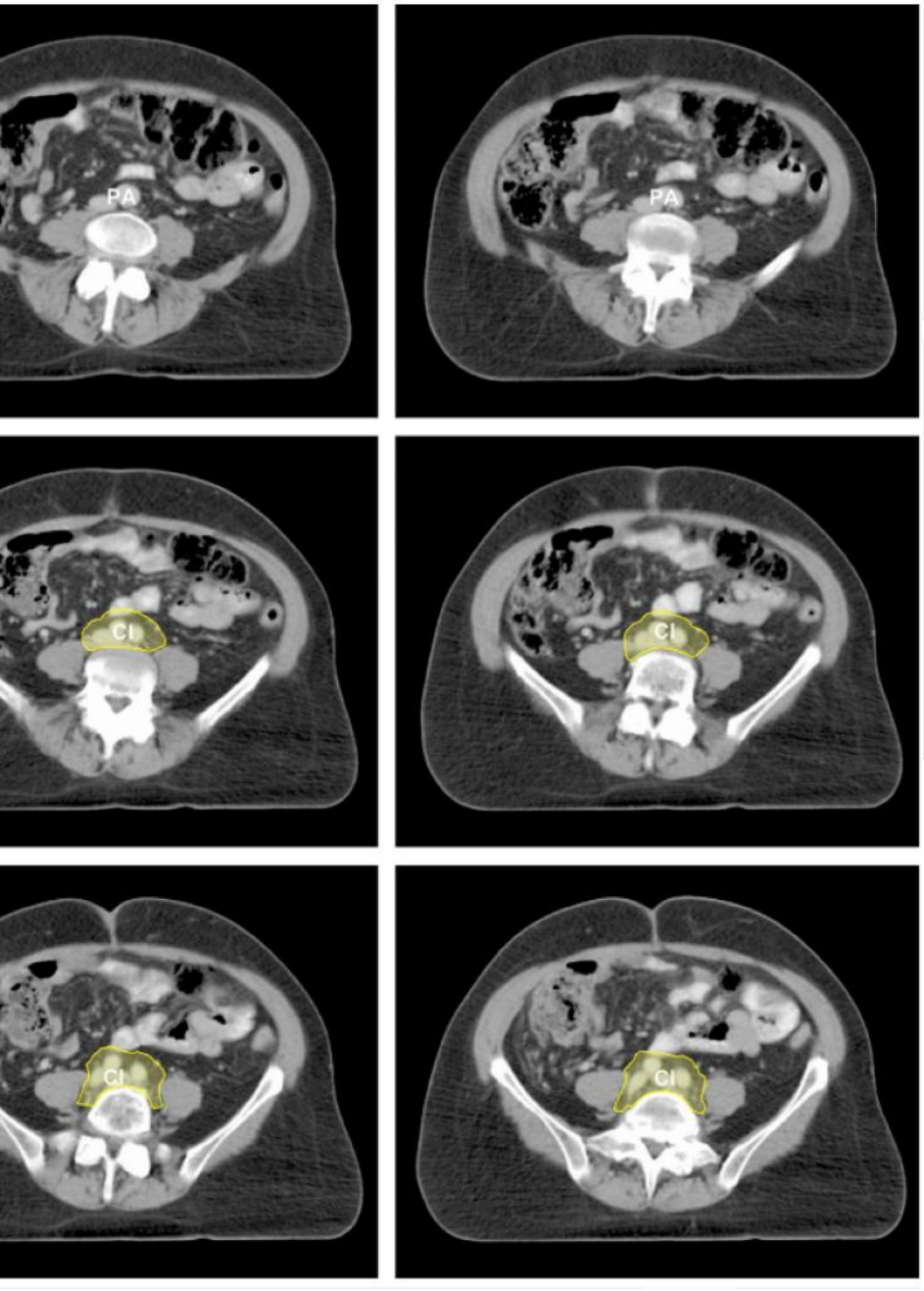


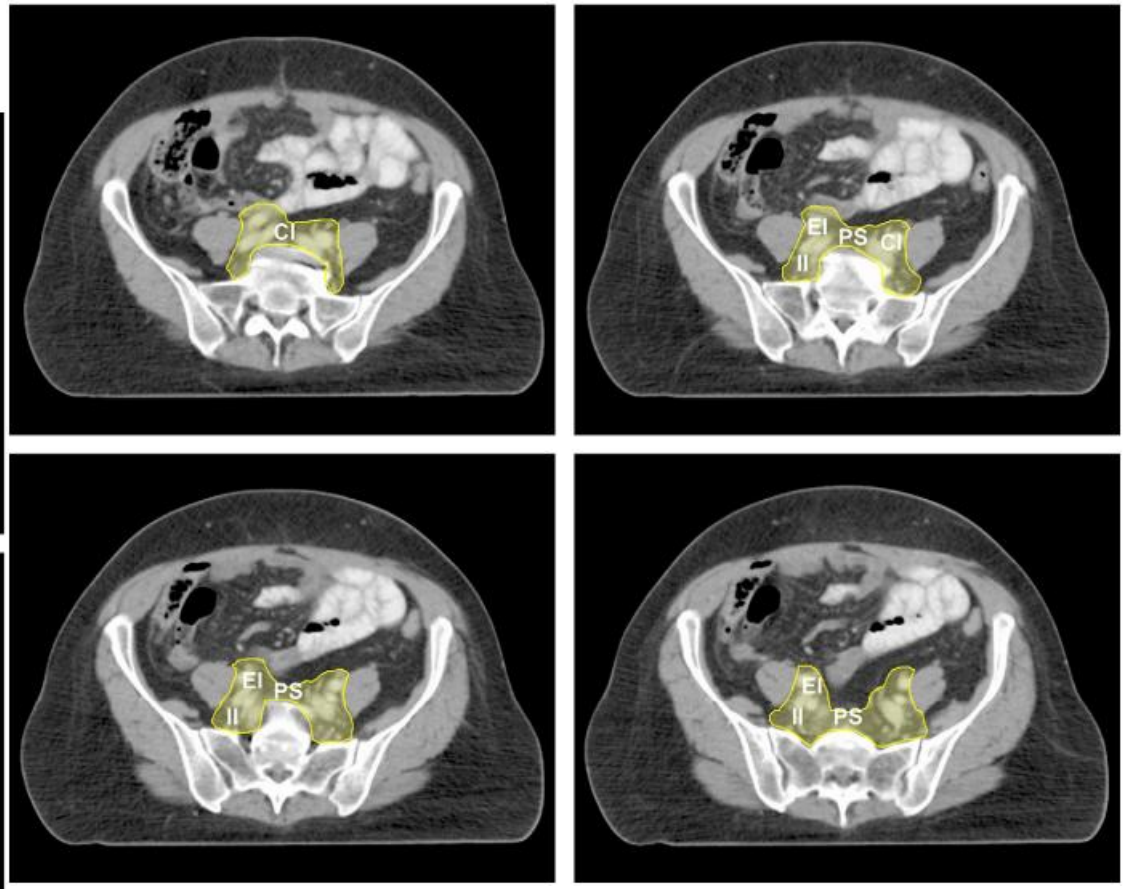


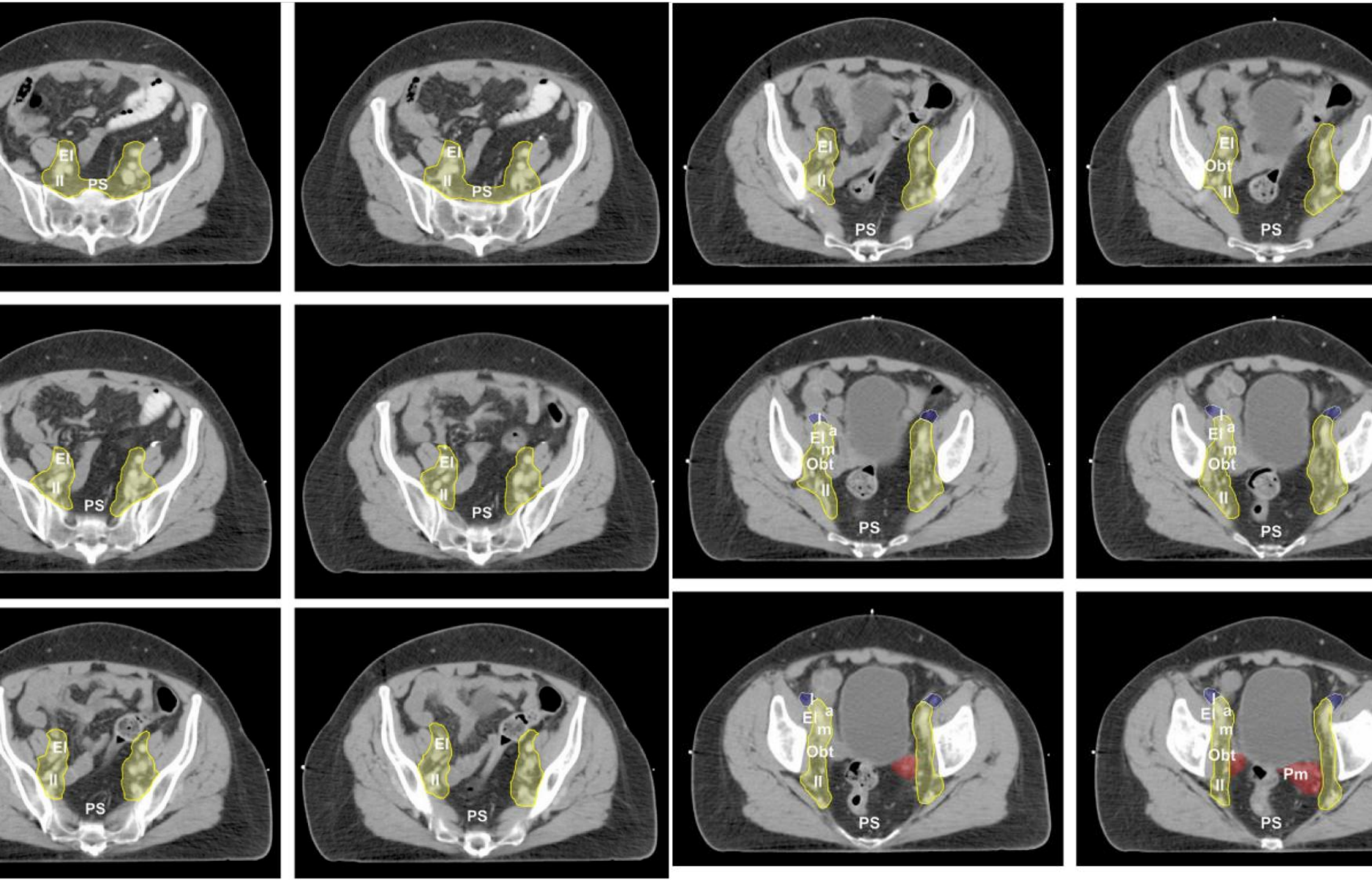
FALLOPIAN TUBES

- **Extend laterally from uterine fundus to ipsilateral ovary and lie in the mesosalphinx , peritoneal fold along the superior margin of broad ligament.**
- **9 to 11 cm long and opens into peritoneal cavity**
- **Has four parts – INTERSTITIAL , ISTHUMUS , AMPULLA and INFUNDIBULUM.**
- **Tube is composed of mucosal lining , muscular layer and outer serosal layer.**
- **Mucosal surface has ciliated cells that assists in propelling the ovum into uterus.**

ODAL STATIONS



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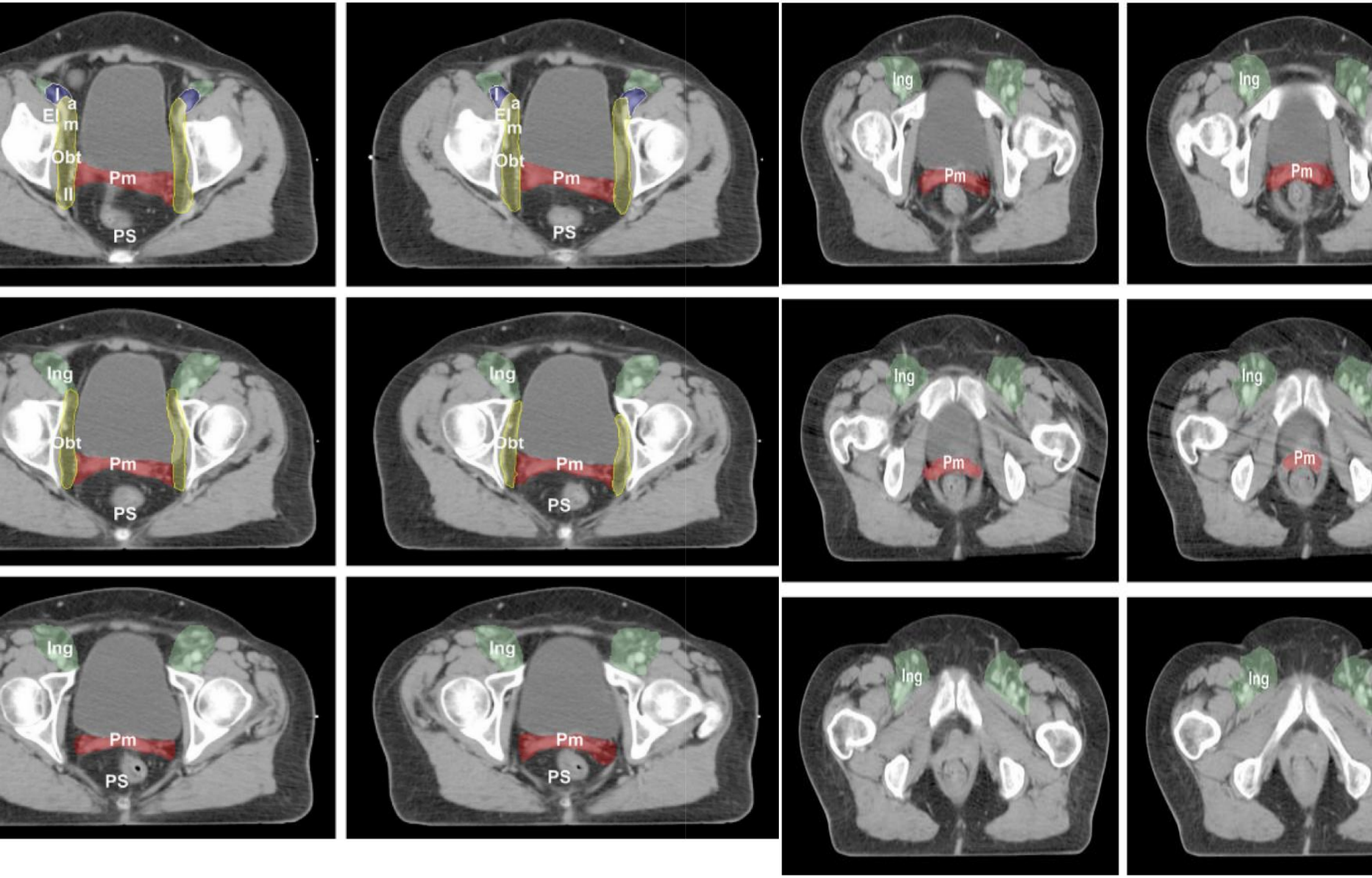
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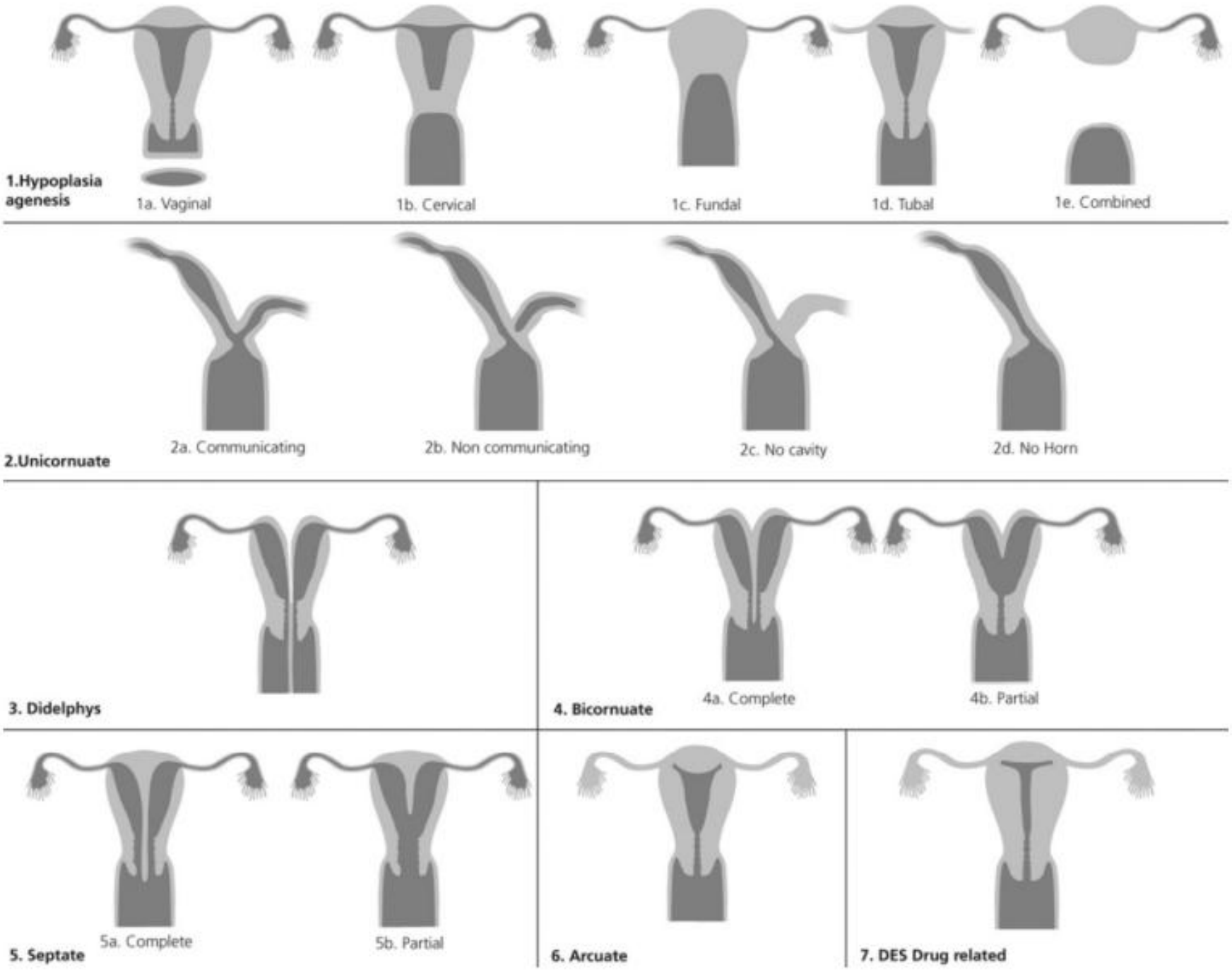
CONGENTIAL ANOMALIES

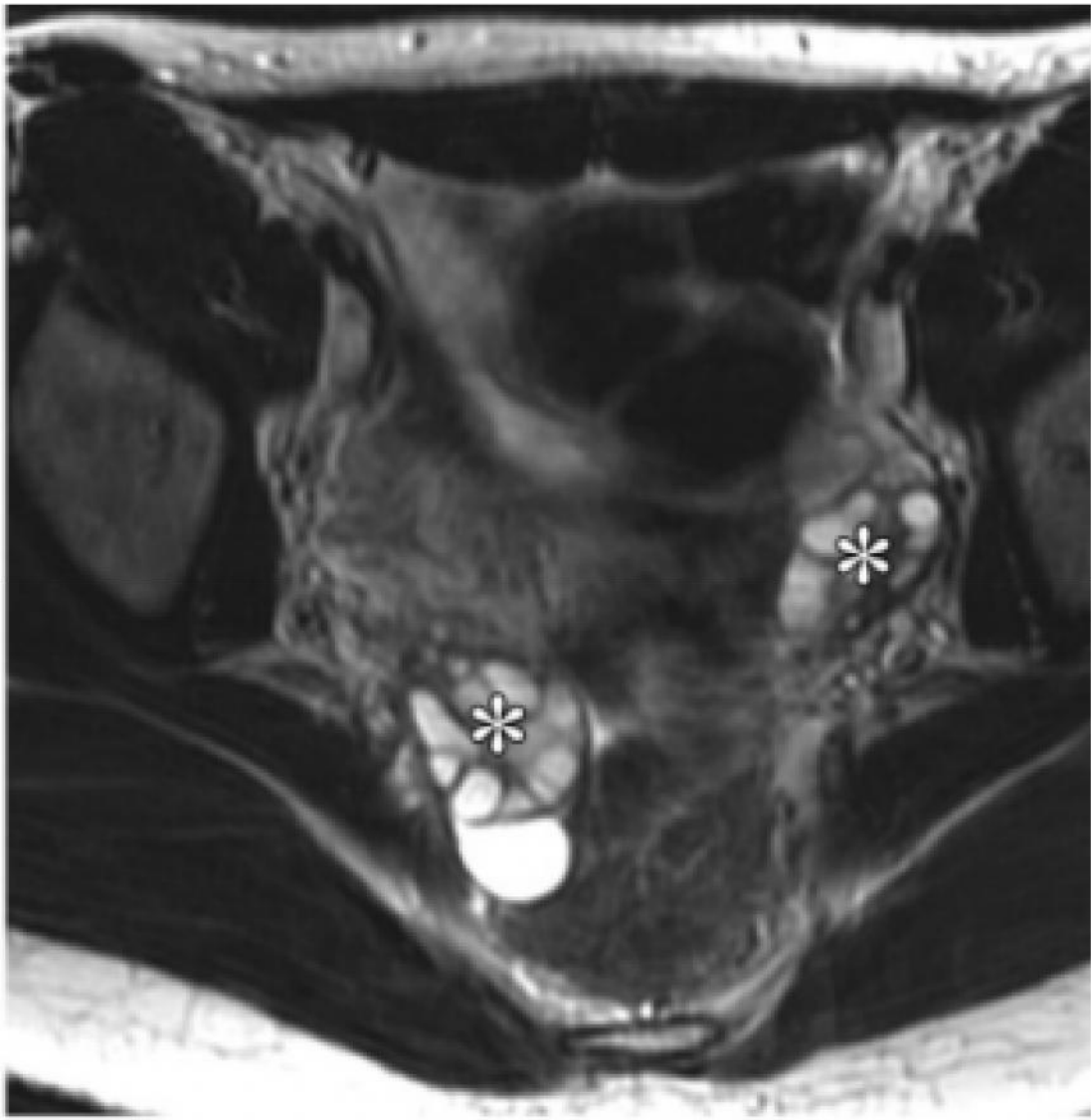
- **Result from abnormal development and fusion of paired mullerian ducts which develop into uterus , upper two thirds of vagina and fallopian tubes.**
- **MRI provides exquisite pelvic anatomy and is accurate imaging technique choice.**
- **Classification of anomalies is important in fertility outcomes and surgical management.**
- **Should include abdominal imaging as its commonly associated with RENAL anomalies.**


1.Hypoplasia agenesis
1a. Vaginal
1b. Cervical
1c. Fundal
1d. Tubal
1e. Combined
2.Unicornuate
2a. Communicating
2b. Non communicating
2c. No cavity
2d. No Horn
3. Didelphys
4. Bicornuate
4a. Complete
4b. Partial
5. Septate
5a. Complete
5b. Partial
6. Arcuate
7. DES Drug related

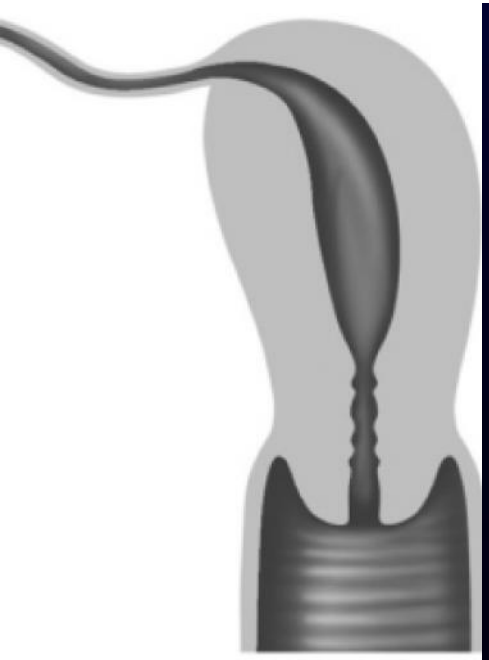
MULLERIAN DUCT ANOMALIES

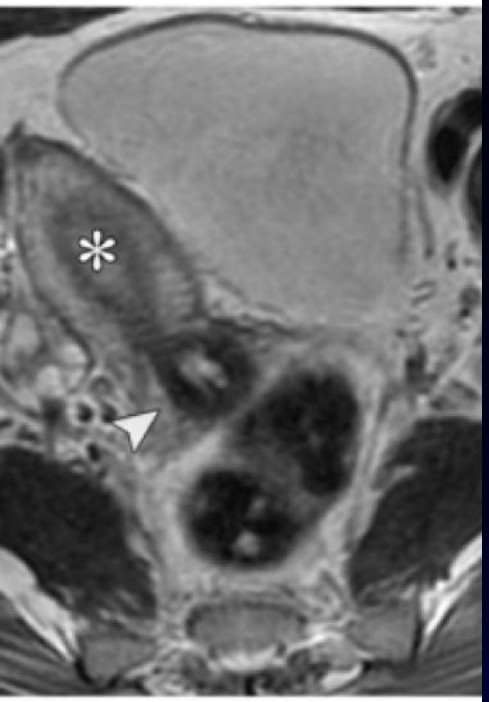
- **CLASS I : UTERINE AGENESIS**
  - **Failure of development of both mullerain ducts .**
  - **Commonest subtype is MAYER ROKITANSKY KUSTER HAUSER (MRKH) SYNDORME – complete agenesis of uterine and vagina with intact ovaries and fallopian tube.**


b
r

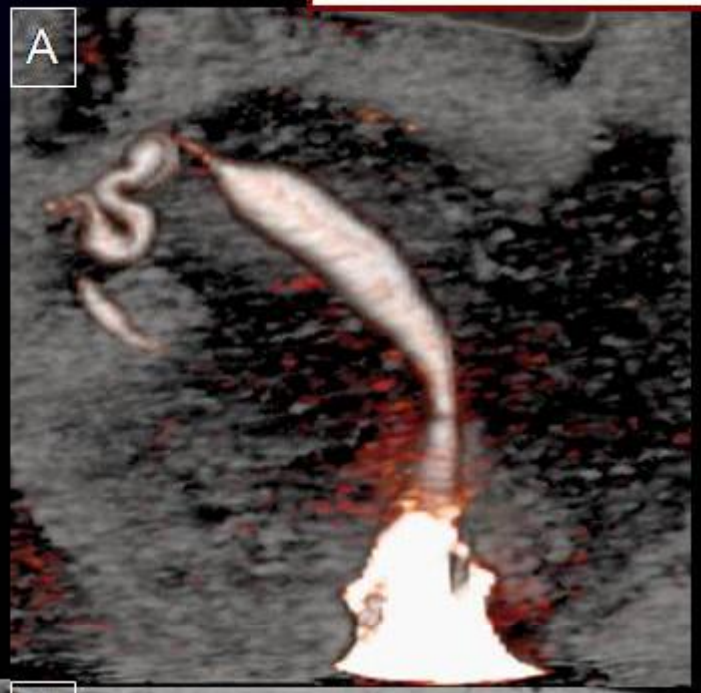


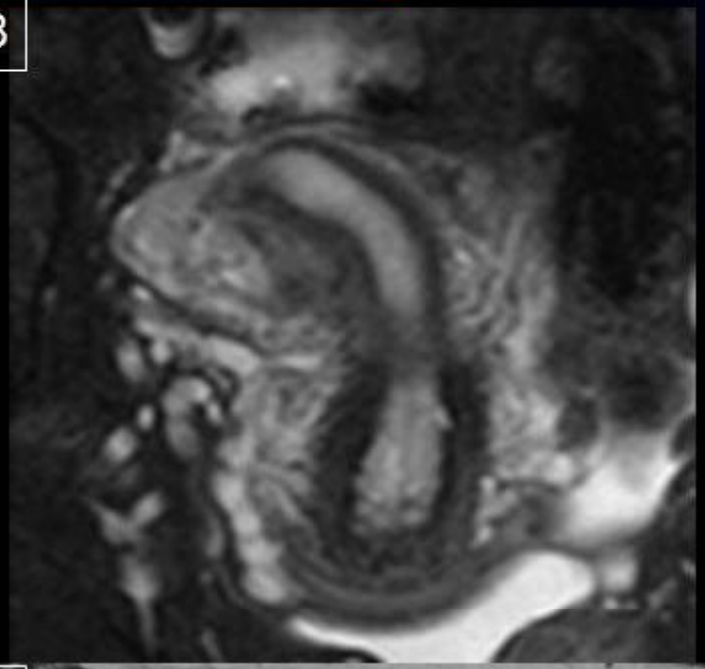
- **CLASS II : UNICORUATE UTERUS**
  - **Failure of normal development of ONE MULLERIAN DUCT , is associated with increased spontaneous abortion and obstetric complications.**
  - **On T2WI , *curved , elongated uterus with tapering of fundal segment off midline(BANANA like configuration) best seen in axial oblique images.***
  - ***Normal uterine zonal anatomy is maintained***
  - **If RUDIMENTARY HORN present – it may be functional and contains endometrium – predispose for endometriosis , hematometra (incase of non communicating horn)**



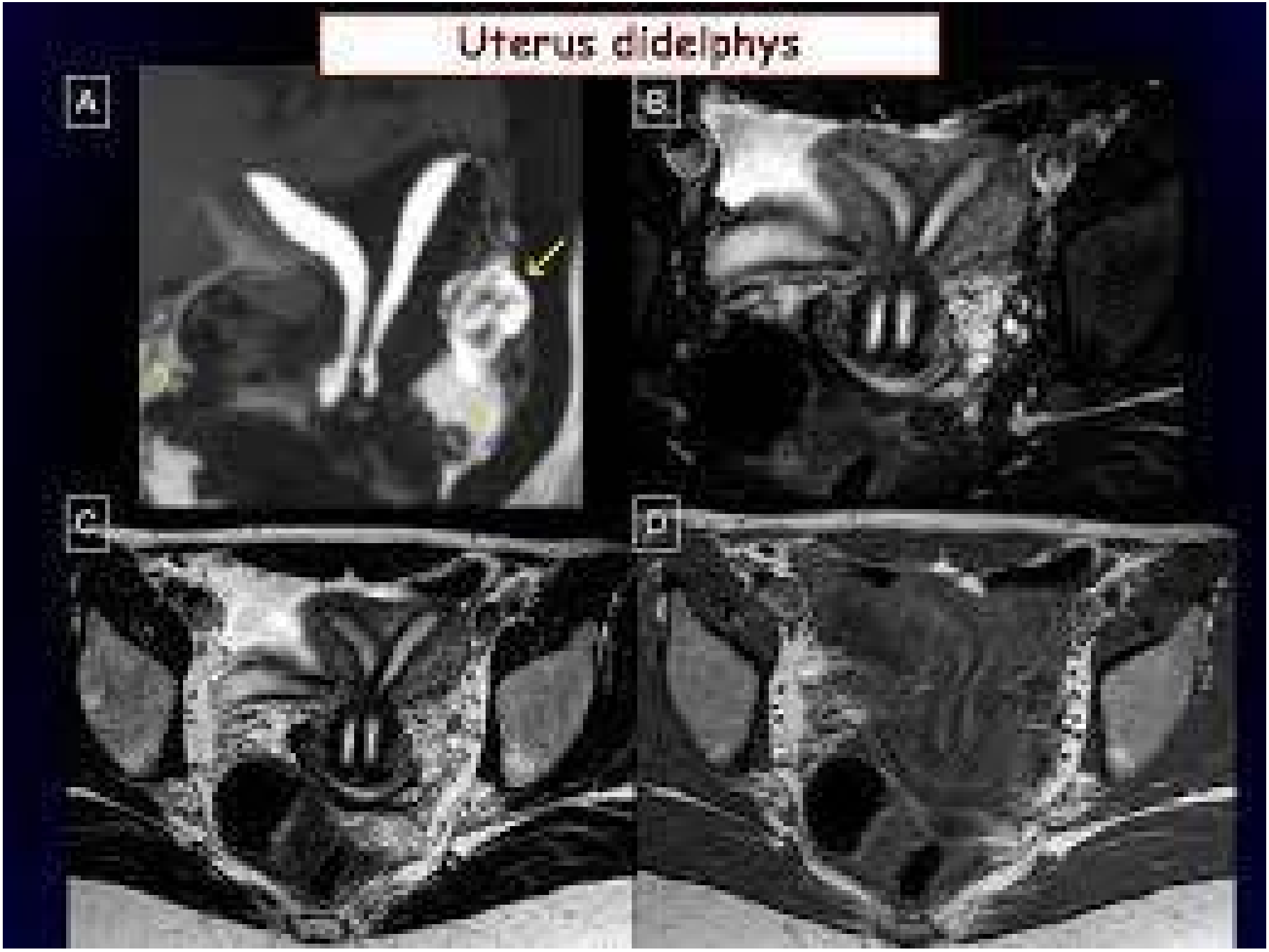


Unicornuate uterus

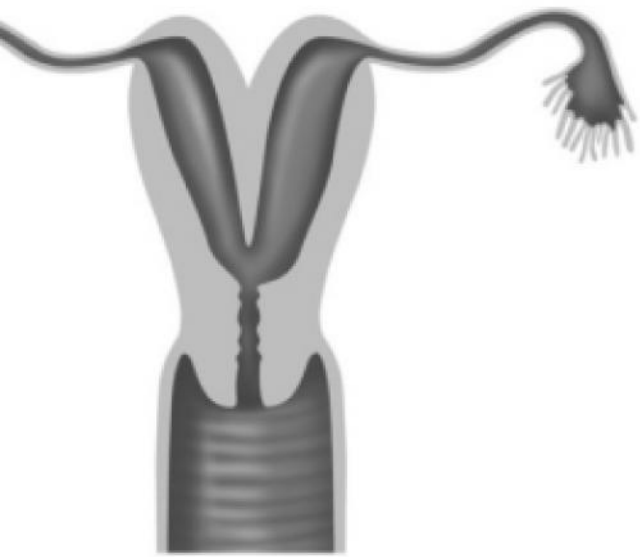


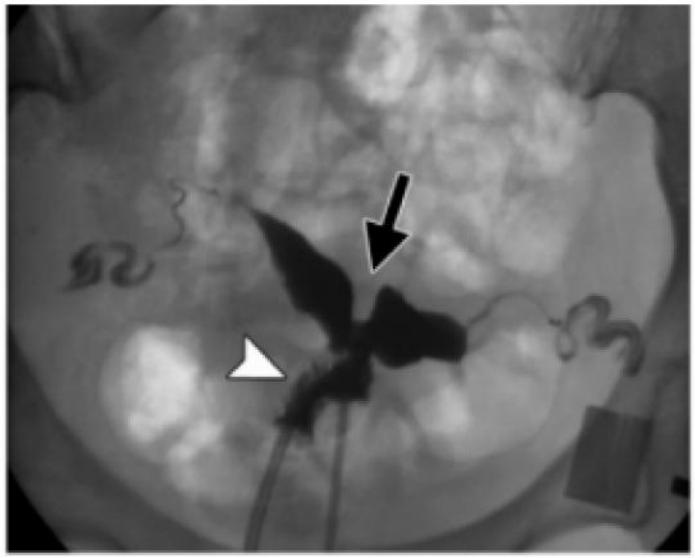


- **CLASS III : UTERINE DIDELPHYS**
  - **NONFUSION of mullerian duct result in uterine didelphys with <u>TWO SEPARATE UTERINE HORN AND CERVIX.</u>**
  - **Two widely placed uterine corpus with normal uterine zonal anatomy with single fallopian tube.**
  - **Large fundal cleft.**
  - **Duplication of cervix**
  - **Longitudinal vaginal septum**


Uterus didelphys
A
B
C
D

- **CLASS IV: BICORNUATE UTERUS**
  - **Is of two type – COMPLETE , PARTIAL**
  - **LACK OF FUSION – unicollis- complete division upto external os , bicolis – divison down to internal os.**
  - **Large fundal cleft**
  - **Intercornual distance >4cm**
  - **Intercornual angle >75 -105 degree.**
  - **Concave heart shaped depression more than 2cm.**
  - **Elongation , widening of cervical canal , isthumus.**





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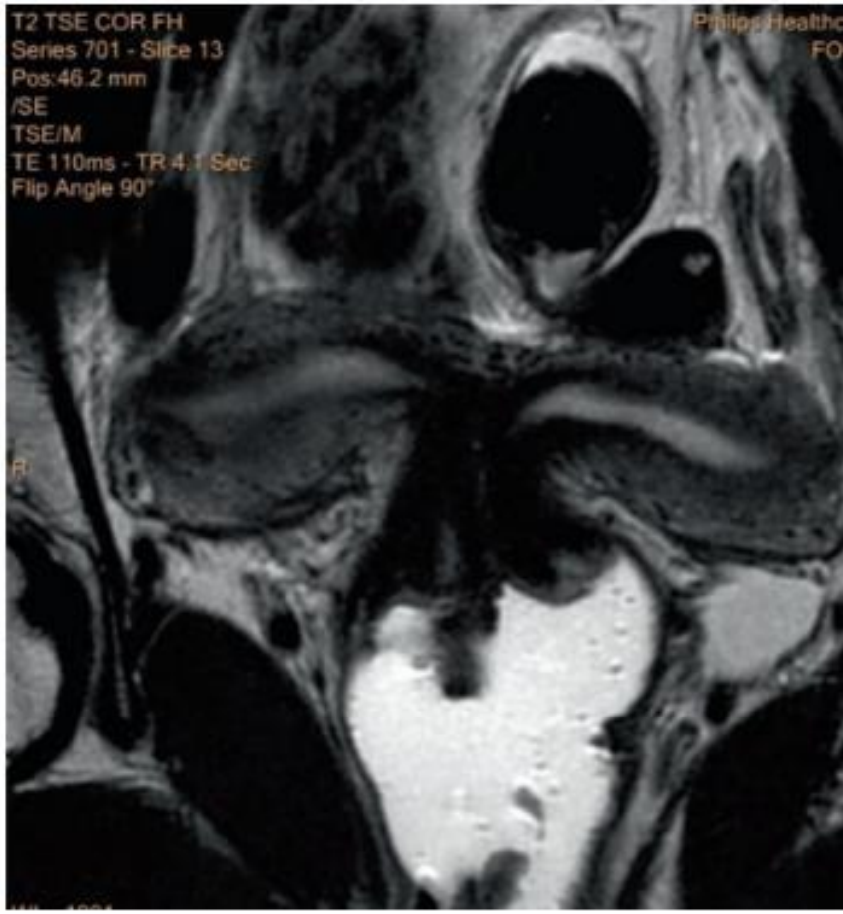
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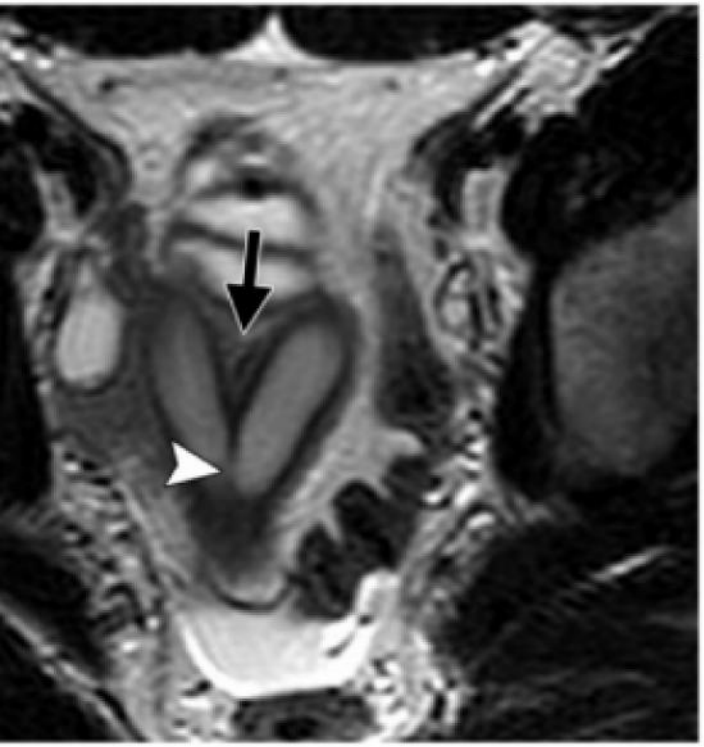
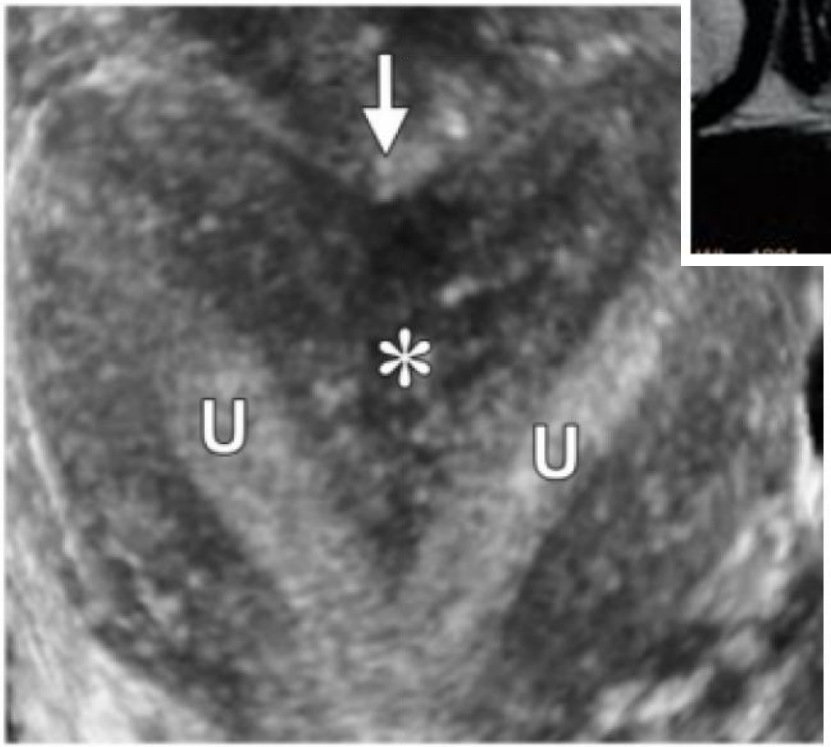
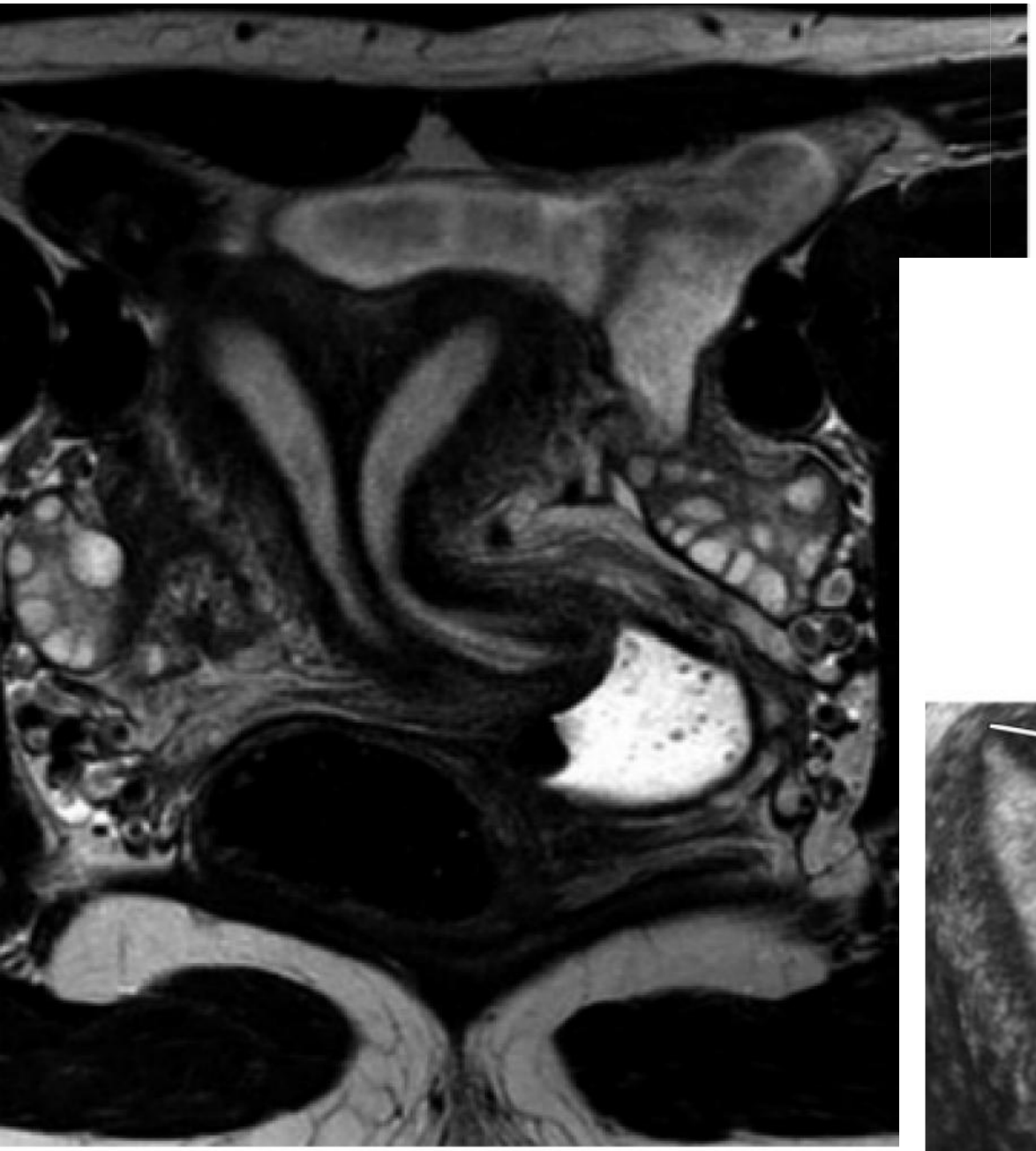
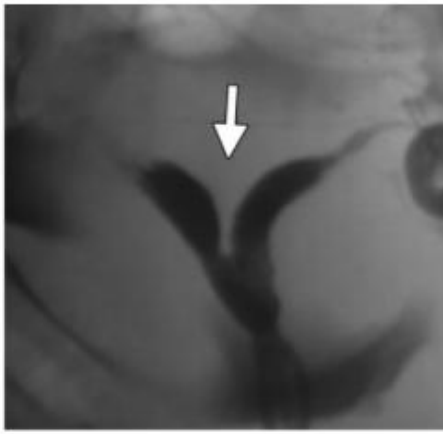



U
U

d

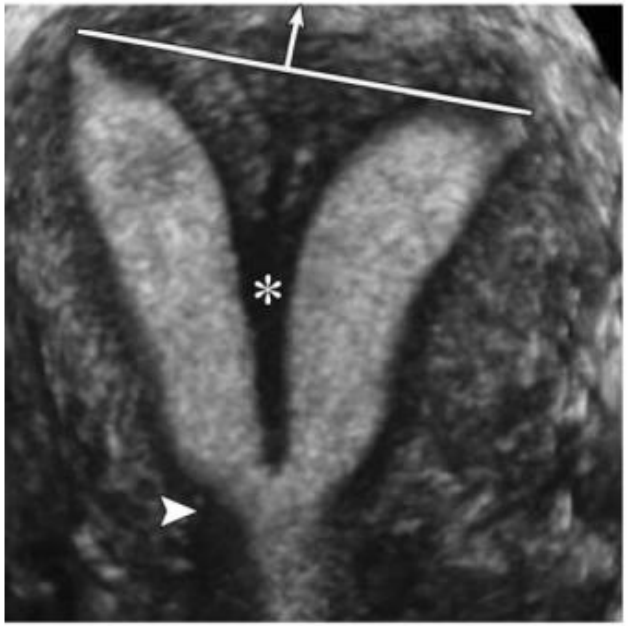
- **CLASS V – SEPTATE UTERUS**
  - **Failure of resorption of septum by 12th week of GA.**
  - **MOST COMMON ANOMALY ASSOCIATED WITH REPRODUCTIVE FAILURE**
  - **Convex/flat / minimally indented (<1cm) external fundal contour.**
  - **Types – UTERUS SEPTUS – complete septum extending to OS , UTERUS SUBSEPTUS – septum upto endometrial canal.**
  - **MR is diagnostic than HSG**

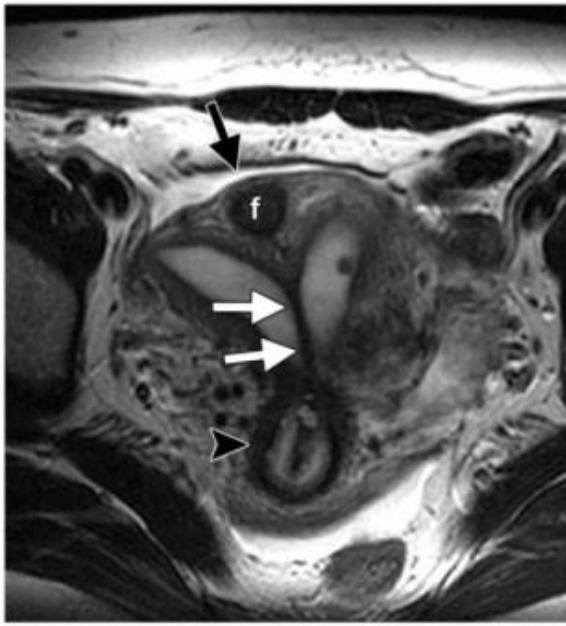




a.

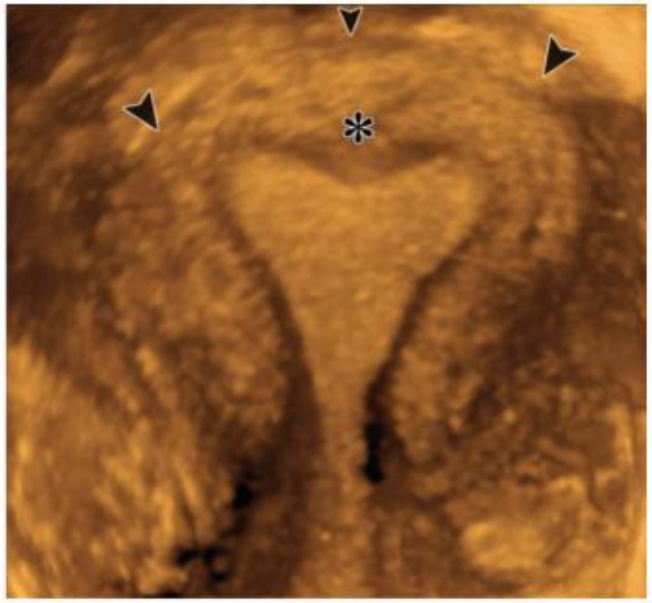
b.





- **CLASS VI – ARCUATE UTERUS**
  - **Near completely resorbed uterovaginal septum.**
  - **NO division of uterine horn**
  - **NORMAL FUNDAL CONTOUR**
  - **Smooth indentation of fundal endometrial canal.**
  - **Single uterine canal with saddle shaped fundus on HSG.**

a.



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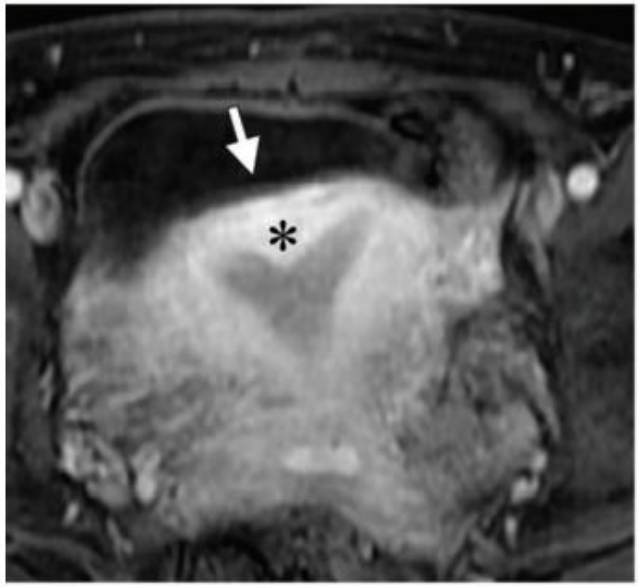


c.

- **CLASS VII- DES associated**
  - **Increased risk of vaginal cancer**
  - **Uterine hypoplasia**
  - **T-shaped Uterus- low uterine volume , uterine fundus thinner than cervix , greater width than depth of corpus + fundus over cervix.**
  - **T-SHAPED LUMEN on HSG**

Vaginal septum anomaly

- **TRANSVERSE SEPTUM : failure of vertical fusion of vaginal plate**
  - **No trans illumination (Ddx- IMPERFORATE HYMEN)**
  - **Fibrous septum with muscular and vascular component.**

- **LONGITUDINAL SEPTUM : failure of fusion of lateral mullerian ducts resulting in duplication of uterus , cervix and vagina or incomplete resorption of vaginal septum.**
  - **Low signal septum with high signal intensity of vaginal mucosa and secretions on T2WI.**
- **IMPERFORATE HYMEN : Failure at very end of vaginal recanalization.**
  - **Primary amenorrhoea with cyclical pain.**
  - **Bulging introitus (TRANSILLUMINATION +)**
  - **Junction between urogenital sinus and sinovaginal bulb.**
  - **HEMATOCOLPOS with HIGH SIGNAL ON T1WI/T2WI –indicative of subacute bleeds.**

UTERINE LEIOMYOMA

Benign overgrowth of smooth muscle and connective tissue.

Most common gynecological malignancy

Types –

1.INTRAMURAL – confined to uterine contour

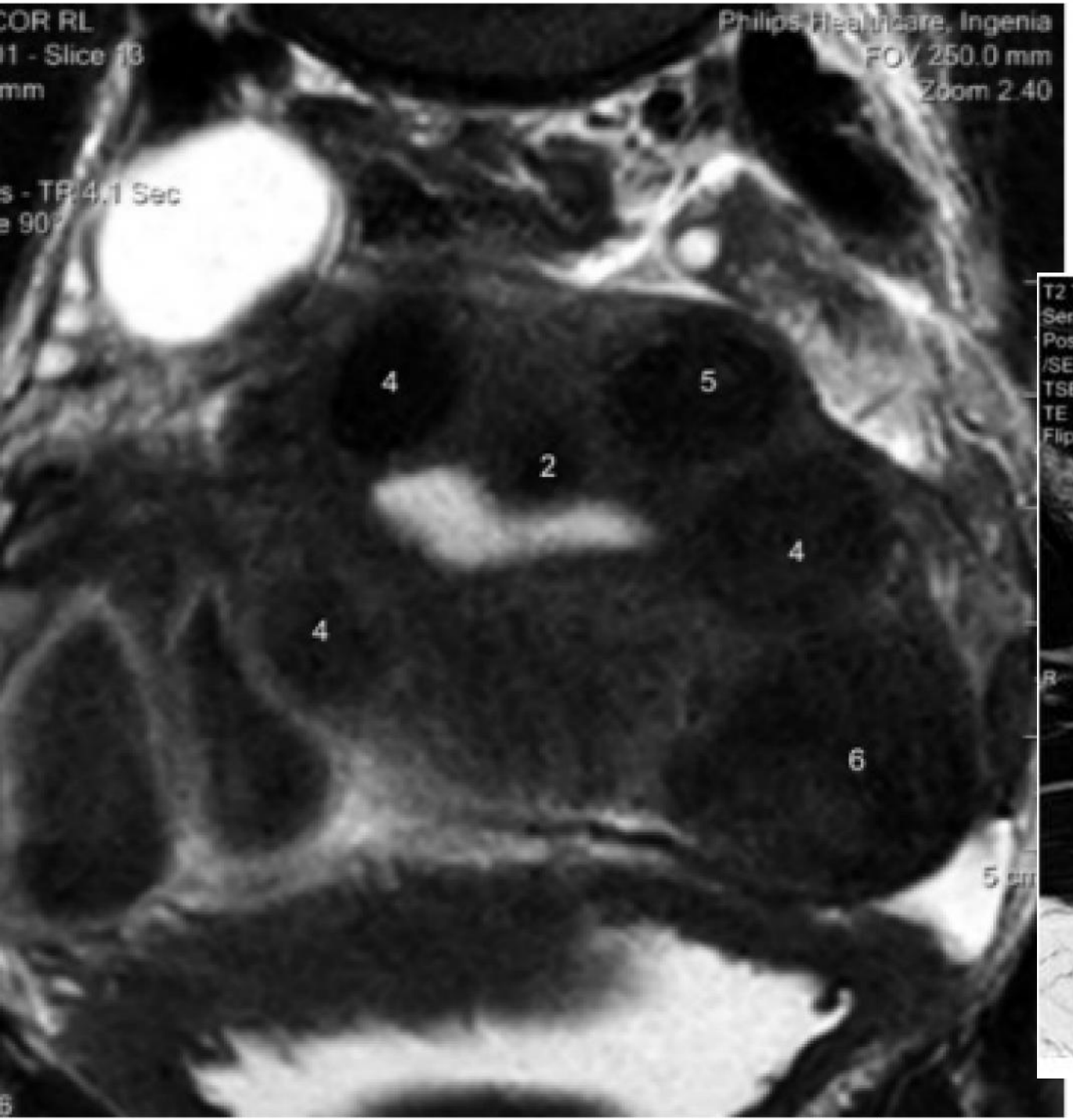
2. SUBSEROSAL/EXOPHYTIC – distortion of uterine contour.

3. SUBMUCOSAL – projecting into endometrial cavity.

CT – iso to hyperdense density , calcification , degeneration(central areas of low attenuation)

MRI- Well circumscribed mas of homogenously LOW SI on T2WI compared with Myometrium. Isointense to myometrium on T1WI.

High SI on T2WI – cystic degeneration.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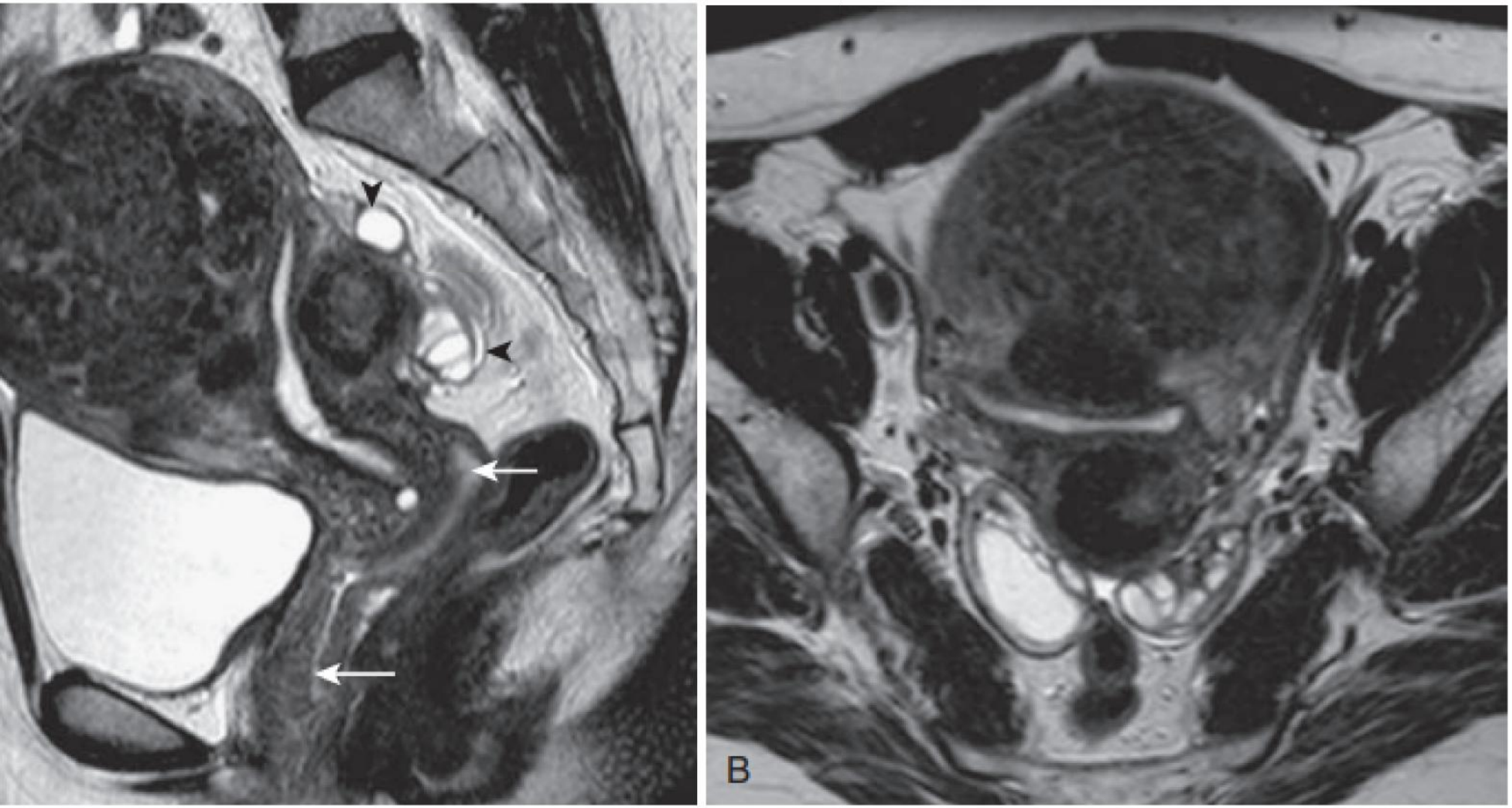

B

OVARIAN TORSION

- **Twisting of ovary on its axis around the suspensory ligament.**
- **Predisposing factors – LARGE CYST(hemorrhagic, paraovarian cyst , malignancy (dermoid) , serous cystadenoma)**
- **< 5cm cyst does not go torsion.**
- **BENIGN MATURE CYSTIC TERATOMA is the most common neoplasm undergoing torsion.**
- **Hypermobility of normal adnexa – Mobile fallopian tube, long mesosalphinx , elongated pelvic ligaments**

most frequent in prepubertal girls + in 1st trimester of pregnancy.

IMAGING CHARACTERISTICS OF OVARIAN TORSION

CT :

Unilateral enlarged ovary with cortical follicles

Displacement of torsed ovary toward the pelvic outline

Deviation of uterus toward side of torsed ovary

Hemorrhagic infarction >50 HU

Twisted vascular pedicle (PATHOGONOMIC)

Ascites

MR :

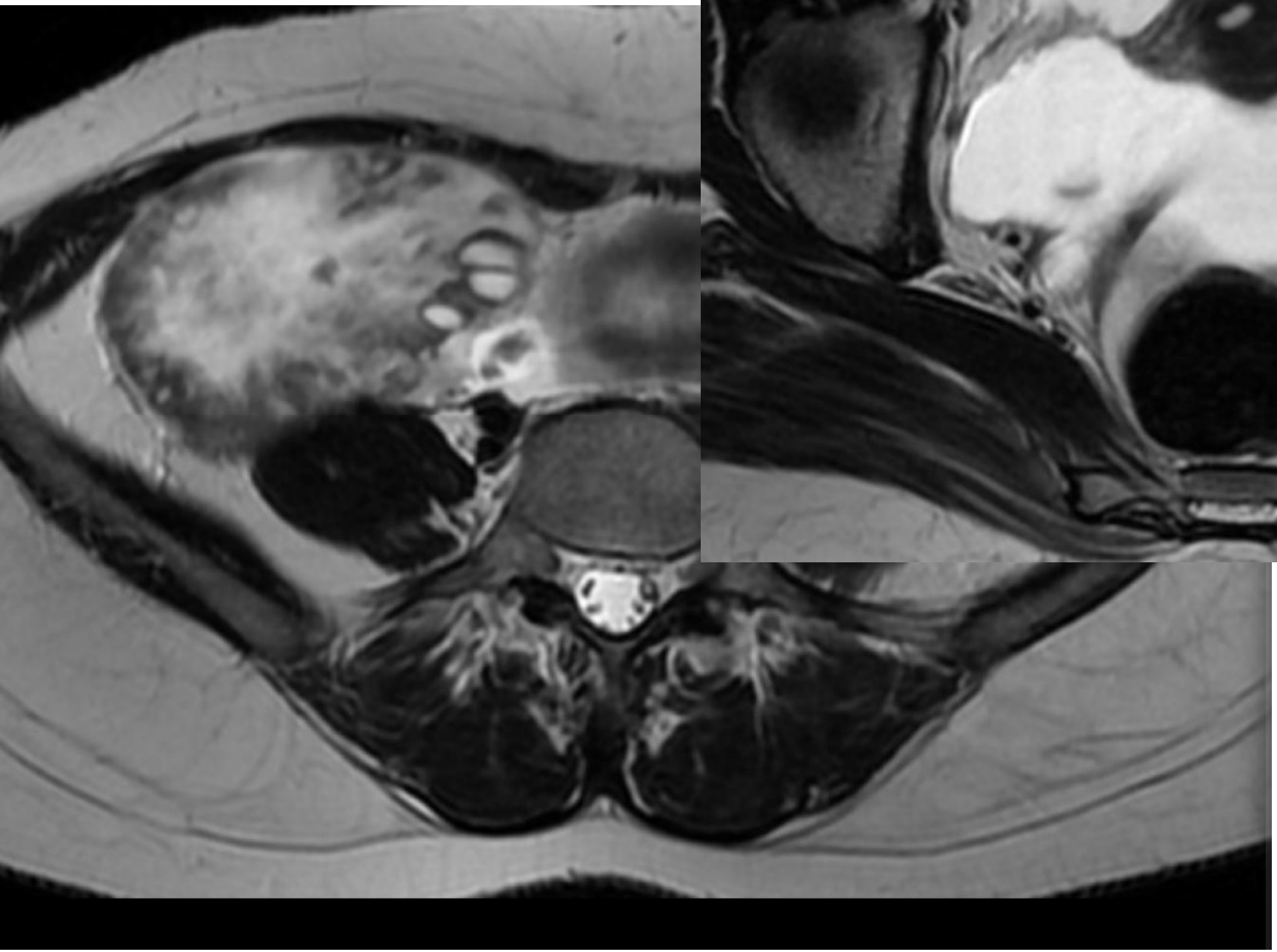
Stromal edema – diffuse T2WI high signal.

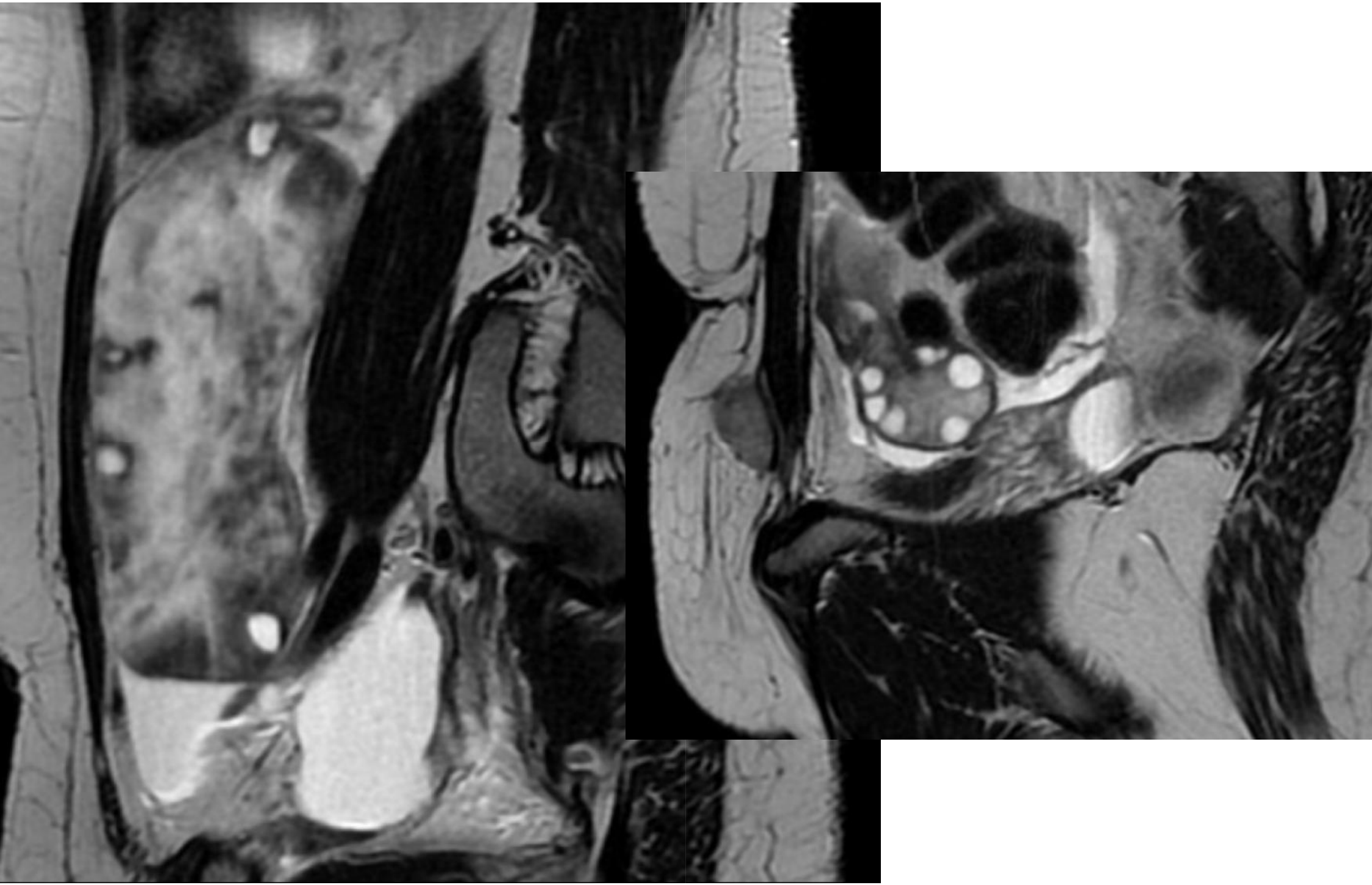
No enhancement of solid component on contrast.

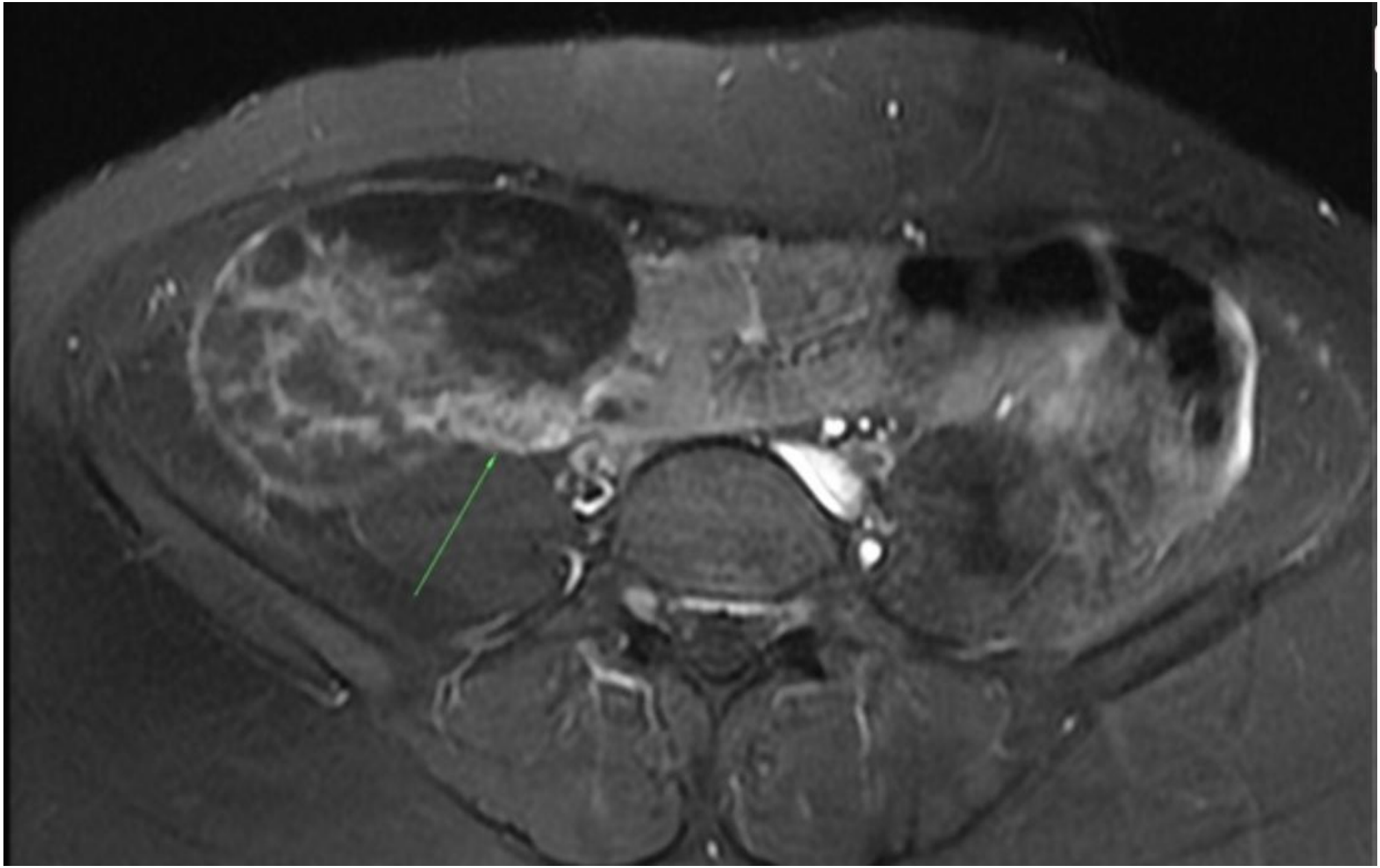
Enlarged follicles to the periphery.

Beaked protrusion of periphery of torsed ovary.

Obliteration of fat planes.







PELVIC CONGESTION SYNDORME

- **Chronic pelvic pain associated with pelvic venous distension + valvular ovarian vein insufficiency.**
- **Uni/bi lateral chronic dull deep pelvic ache .**
- **Ovarian point tenderness**

- **IMAGING FEATURES**

CT /MRI : dilated tortuous enhancing tubular structures

ANGIO (SELECTIVE CATHETERIZATION OF OVARIAN VEINS)

Ovarian vein diameter >10 mm

Retrograde flow in ovarian / pelvic veins

Tortuous collateral pelvic venous pathways

Delayed clearance of contrast from veins.

ADENOMYOSIS

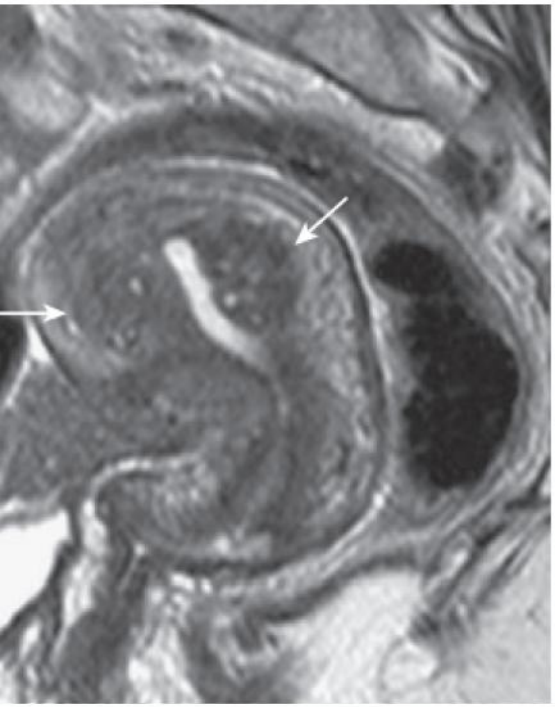
- **Focal / Diffuse benign invasion of myometrium by endometrium(heterotrophic endometrial islands) inciting reactive myometrial hyperplasia (SMOOTH MUSCLE)**
- **Endometrial glands deeper than ¼ of myometrium (2-3mm below endometrial myometrial junction)**
- **Globular uterine enlargement.**

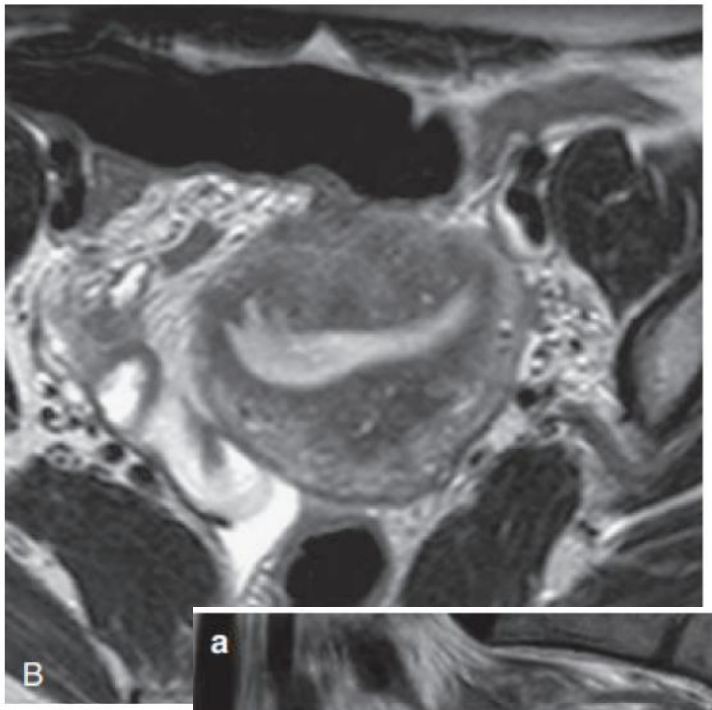
MRI-

Enlargement of uterus

Widening of junctional zone >12mm hypo intense T2WI

DIFFUSE / FOCAL THICKENING OF JUNCTIONAL ZONE forming a ill defined area low SI +/- embedded bright foci of T2WI(islands of ectopic glands)

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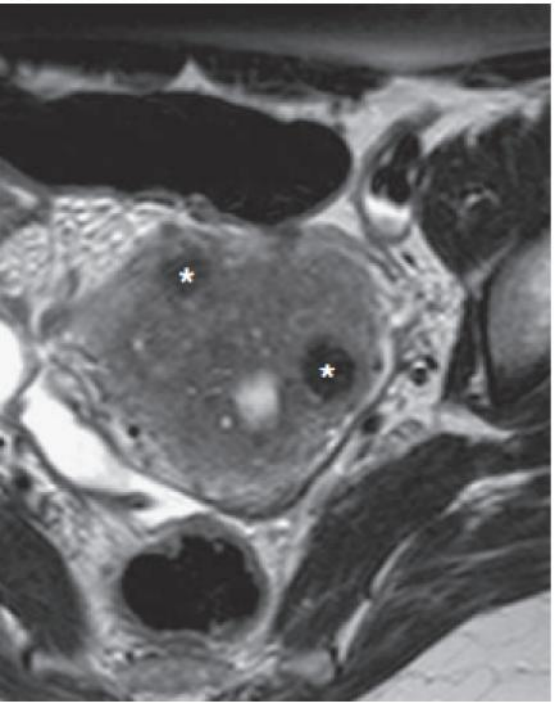



a

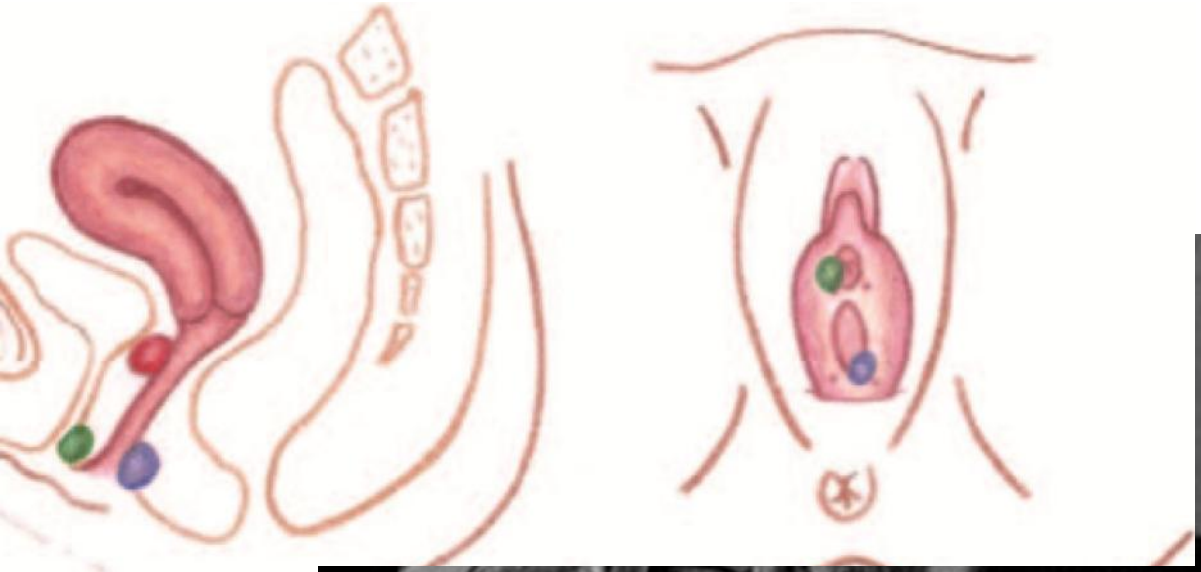

b

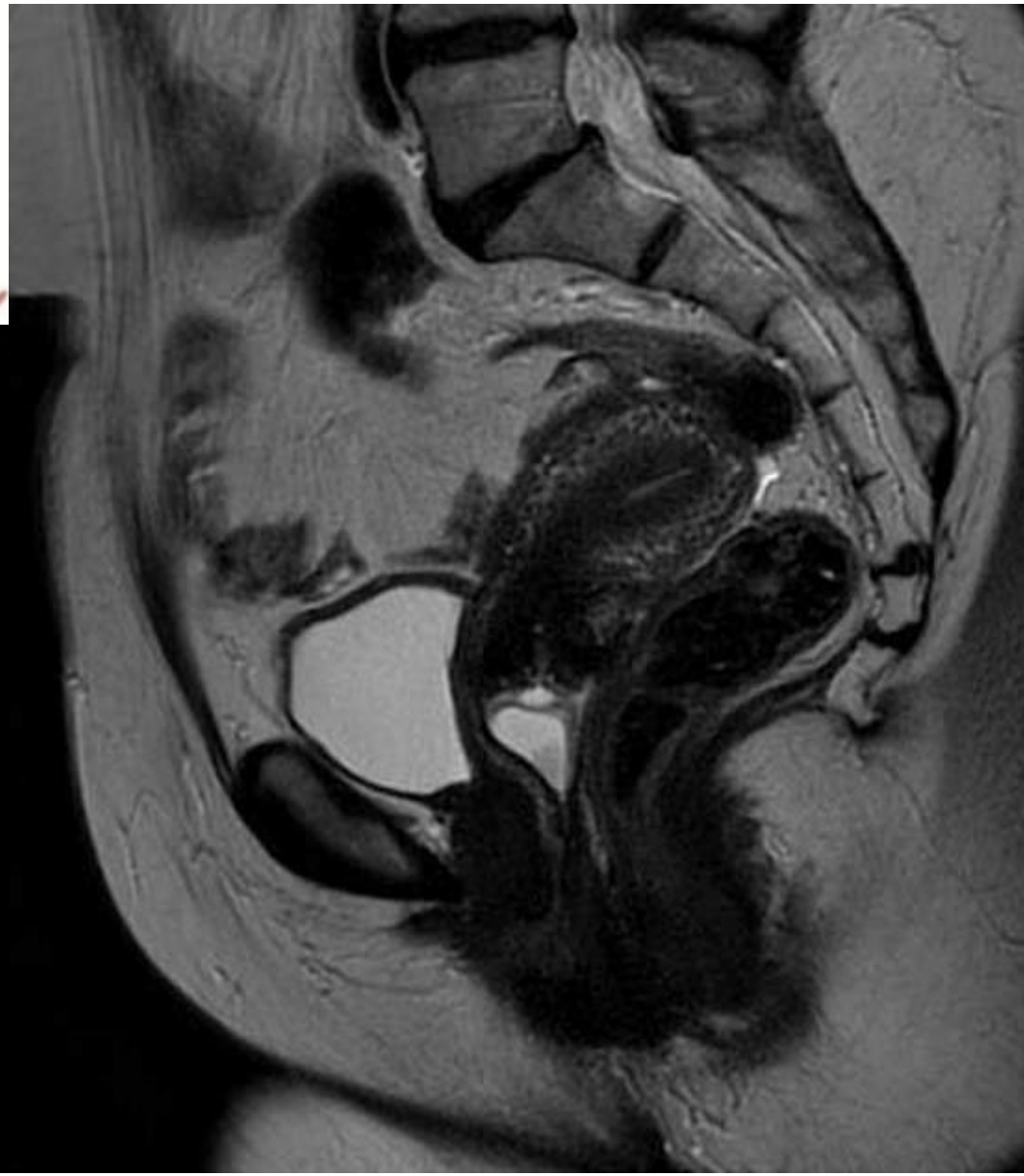
VAGINAL CYSTS

- **Paramesonephric cyst and gartner duct cyst**
- **Appear as T1 hypointense and T2W hyperintense – in *vaginal anterolateral wall anywhere from cervix to introitus.***
- **may be T1 hyperintense if proteinaceous or hemorrhagic content is present.**

BARTHOLIN CYST

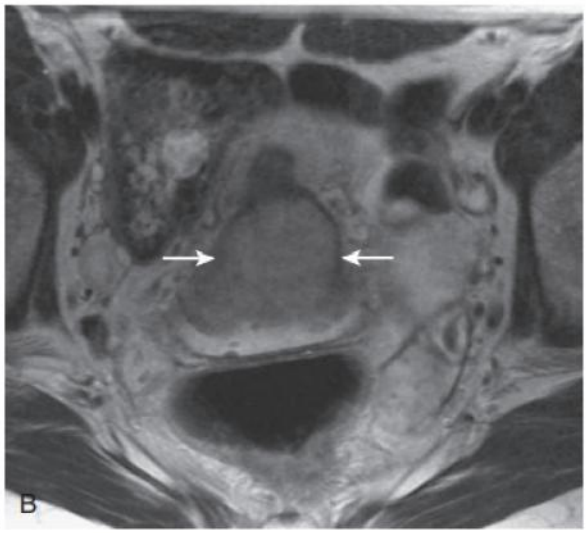
- Most common vulval cyst
- Are of urogenital sinus arising from Bartholin glands
- Women of reproductive age
- Located at lateral introitus adjacent to labia minora
- Lesion typically T2W hyperintense with variable signal on T1 depending on protein content.





CERVIX CARCINOMA

- Typically arises from squamocolumnar junction.
- HPV infection is central to development of cervical cancer.
- NORMAL CERVIX- trilaminar pattern of signal intensity with T2 hyperintense enodcervical canal surrounded by T2 hypointense stroma and rim of intermediate signal intensity smooth muscle.
- CERVICAL carcinoma – invasion of cancer into stroma results in enlarged barrel shaped cervix with abnormal intermediate to high intensity T2 signal that replaces the low signal intensity cervical stroma.
- Restricted diffusion on DWI and ADC.
- Invasion of T2 hyperintense lesion causes loss of normal T2 hypointense muscle layer and loss of fat plane.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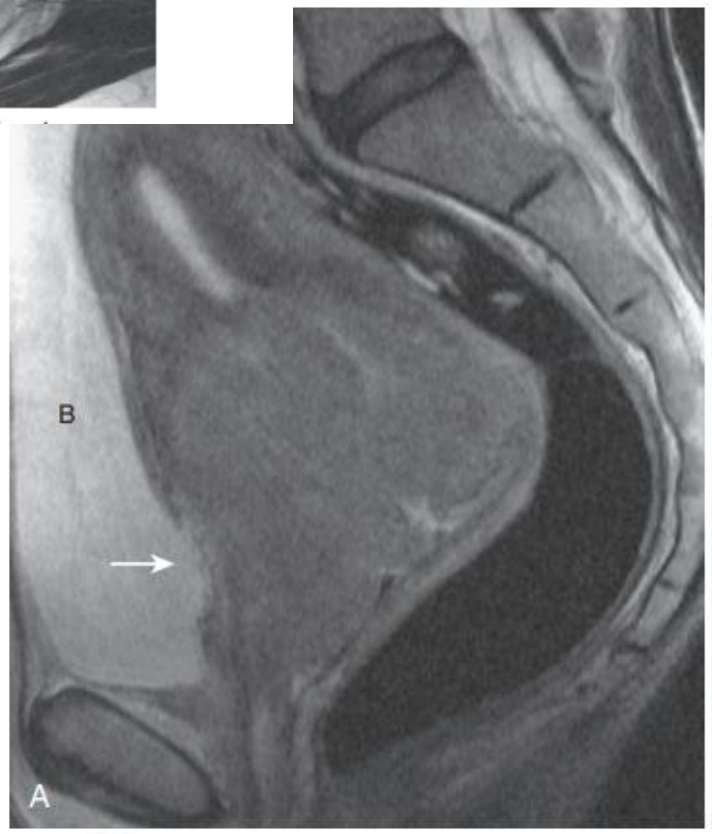
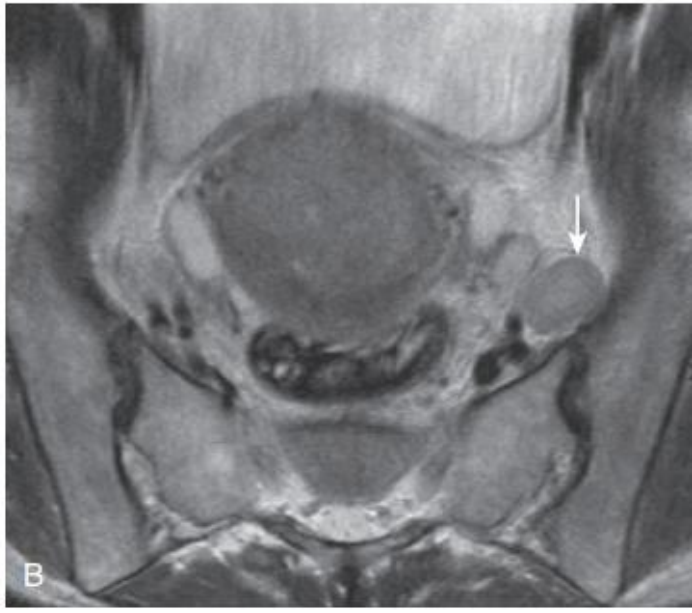
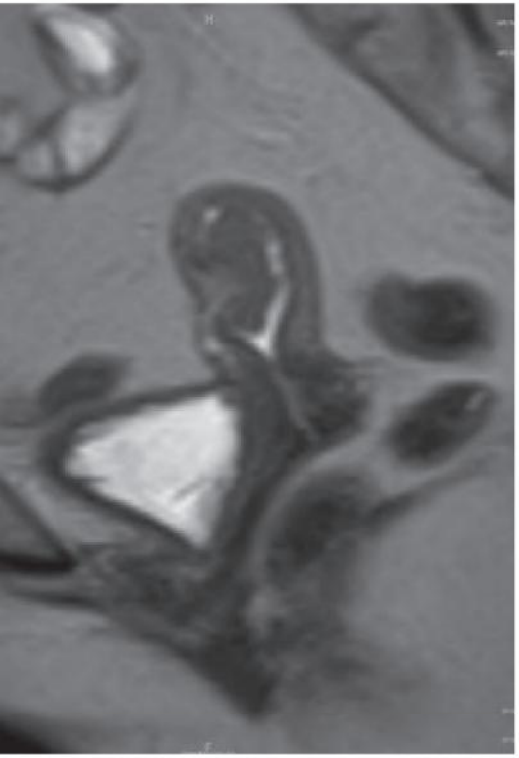

B
A


B

Endometrial carcinoma

- Most common manifestation – abnormal uterine bleeding in a postmenopausal women.
- MRI – T1 isointense and T2 hypointense relative to normal endometrium.
  - STAGE I – CONFINED TO UTERUS
  - STAGE II – EXTENSION INTO CERVIX (T2 Hyperintense lesion invading the T2hypointense cervical storma
  - STAGE III- LOCAL or regional spread (A- adnexa,B – Parametrium or vaginal involvement , C – lymphnodes involvement)
  - STAGE IV – direct invasion in to bladder or rectal mucosa(A) , distant metastasis (B).

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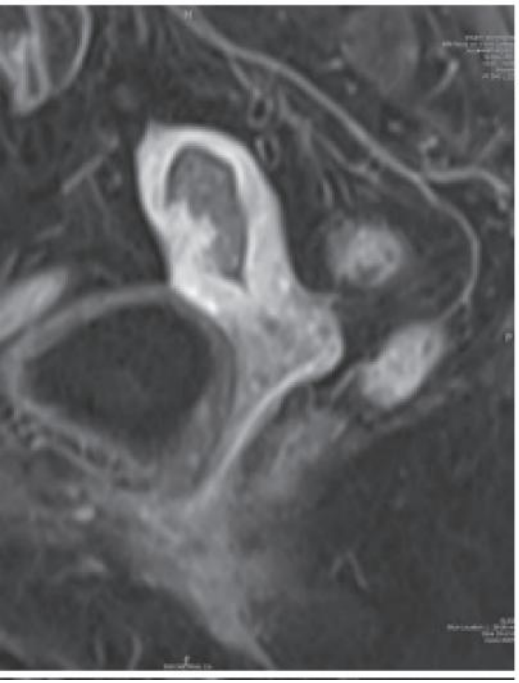


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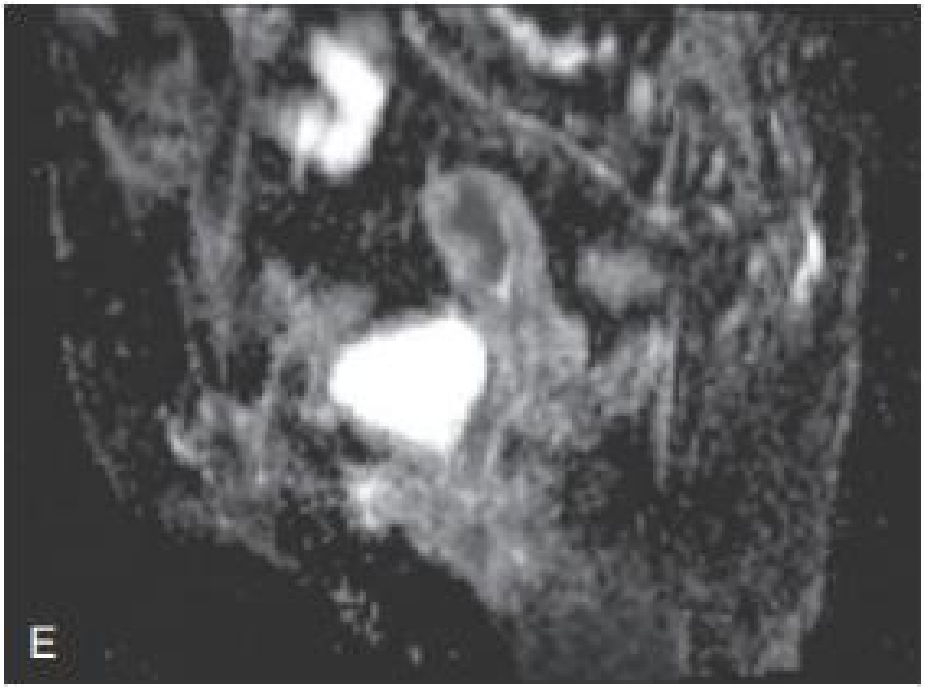

E

Vaginal cancer

90 % composed of SCC

Risk factor – HPV infection, prior radiation, smoking, mmunosuppression.

Commonly seen arising from the posterior wall of posterior third of vagina and tends to demonstrate early involvement of adjacent structures.

sointense on T1W and intermediate to high signal on T2W with enhancement on post contrast images.

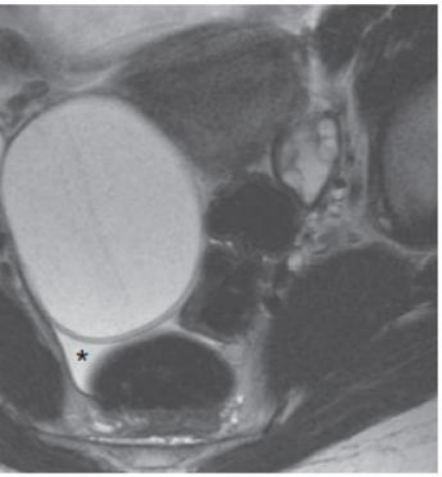
- STAGE I- confined to vagina, with fat plane maintained.
- STAGE II- Extend into paravaginal fat plane with disruption of normal fat signal
- STAGE III – extends to pelvic sidewall with disruption of normal low signal in T2W of pelvic sidewall muscles
- STAGE IV – extend beyond pelvis .


MRI


MRI

OVARIAN CYST

- **Physiologic cyst-** unilocular and low density on CT, low signal on T1W and High signal intensity on T2WI. Thin enhancement of walls with no internal enhancement on post contrast Images.
- **Corpus luteal cyst** may be complicated by internal hemorrhage is referred to as Hemorrhagic cyst. MRI – high signal in T1WI .
- **Peritoneal inclusion cysts-** result of active ovaries , pelvic adhesion and impaired absorptionof peritoneal fluid. May take shape of peritoneal cavity. **Exclusively in premenopausal women as a result of endometriosis, PID or prior pelvic surgery.**
- **IMAGING**- unilocular or multilocular cystic adnexal masses that conforms to the shape of peritoneal cavity.
- MRI – Hyperintense signal on T2 WI , low signal in T1WI
- CT – Low density .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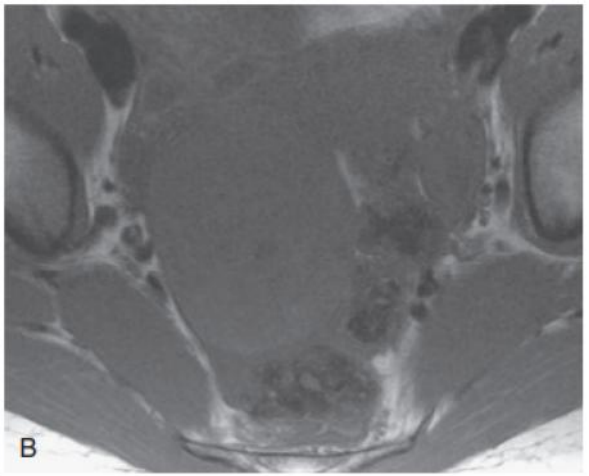
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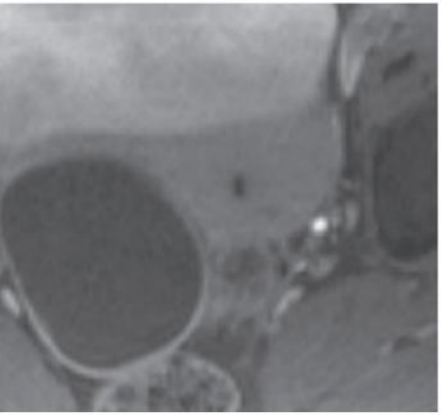
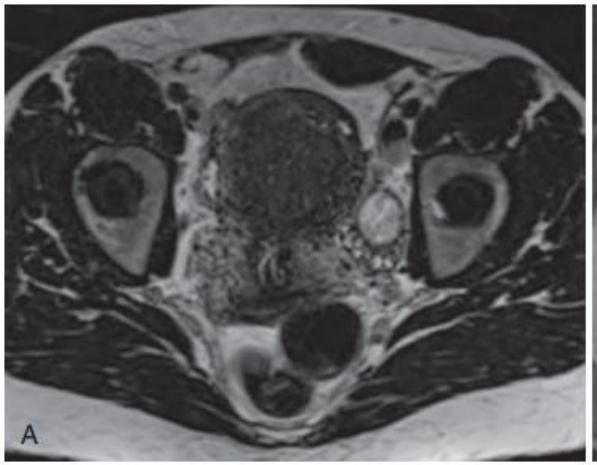
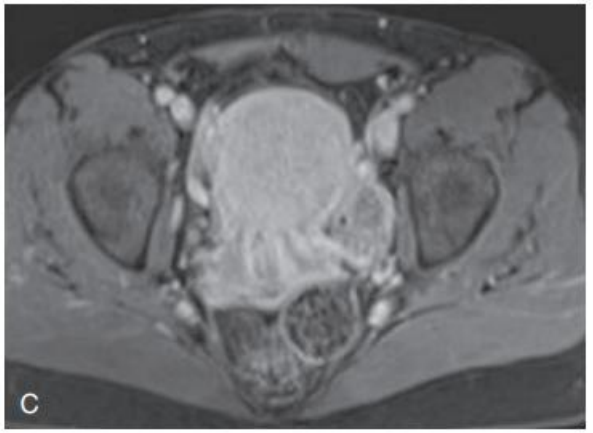



A


B


C

OHSS – bilateral enlarged ovaries containing multiple varied sized theca lutein cysts.

CT & MRI – cyst demonstrate simple fluid density and signal without mural thickening or nodularity.

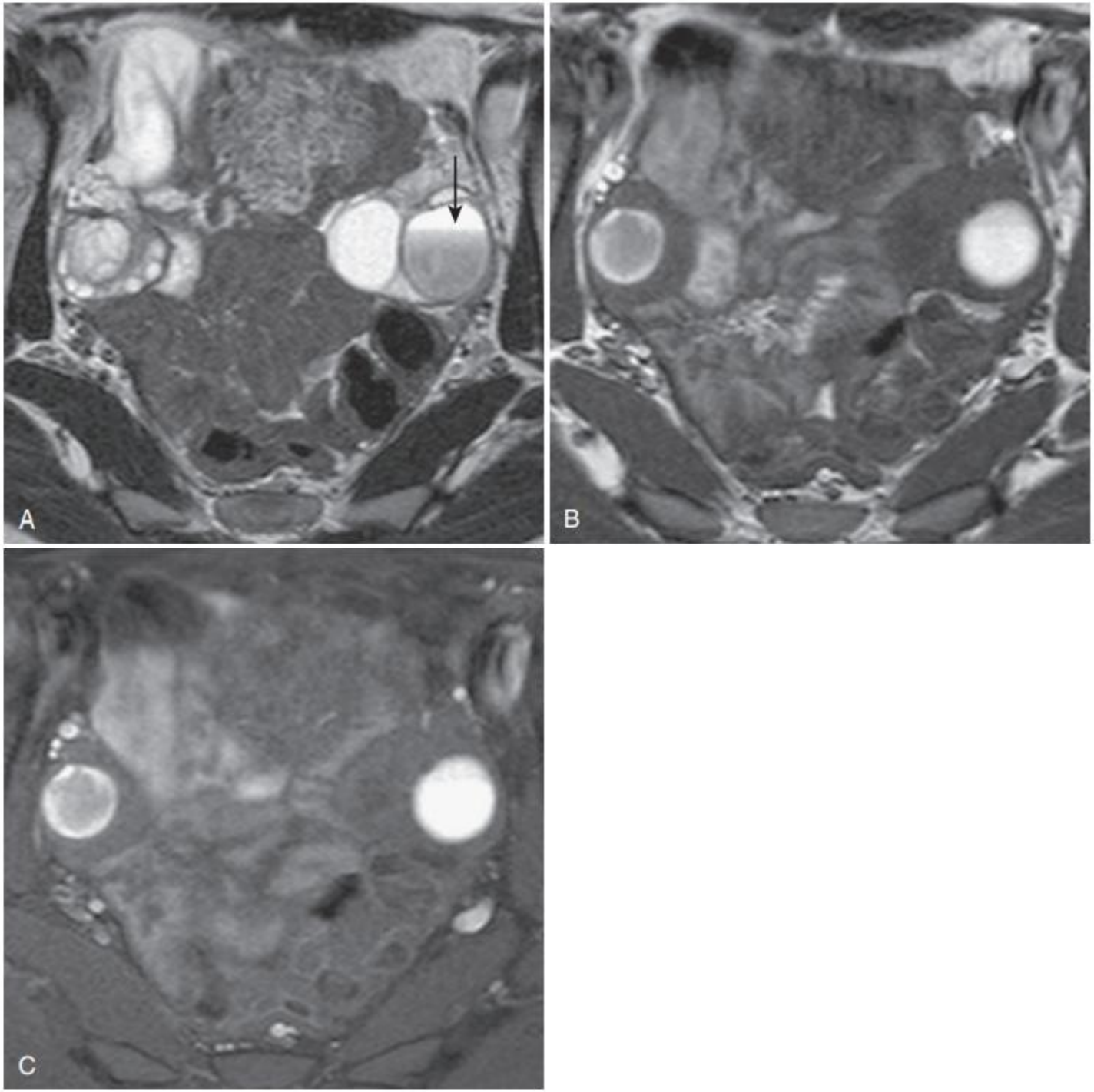
Polycystic ovary syndrome- endocrine disorder characterized by **hyperandrogenism and chronic anovulation.**

Polycystic ovaries are defined by US when one or both ovaries demonstrate more than 12 follicles or more measuring 2 to 9 mm in diameter or ovarian volume exceeds 10 cm.

MRI – enlarged ovaries with 2 to 9mm follicles in subcapsular location.

ENDOMETRIOSIS

- **Endometrial tissue outside the endometrial cavity and responds to cyclical hormone stimulation.**
- **Most common cause of chronic pelvic pain.**
- **Forms – peritoneal endometriosis , adhesions, deep infiltrating endometriosis and tubal endometriosis.**
- **MRI –**
  - **ADHESIONS- spiculated low signal intensity stranding in T1,T2WI with secondary signs such as angulation of bowel , elevation of posterior fornix , posterior displacement of uterus with loss of fat palne between the structures.**
  - **ENDOMETRIOMA – HIGH SIGNAL INTENSITY ON T1 and LOW SIGNAL INTENSITY on T2. depends on the chronicity of blood products. T2 shading – finding of LOW SIGNAL intensity on T2W in hyperintense lesion(characterizing point in differentiating from HEMORRHAGIC CYST)**
  - **Endometrioma have fibrous capsule demonstrated by low signal intensity on T1 and T2 W images.**


A
B
C

OVARIAN CARCINOMA

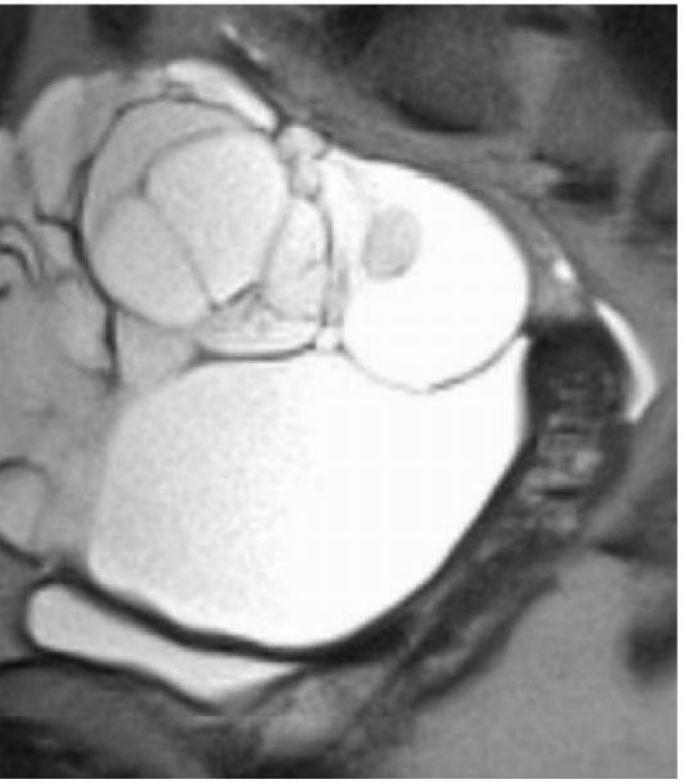
Serous - More of bilateral , unilocular or multilocular with homogenous density on CT , homogenous low signal T1 , High signal T2.

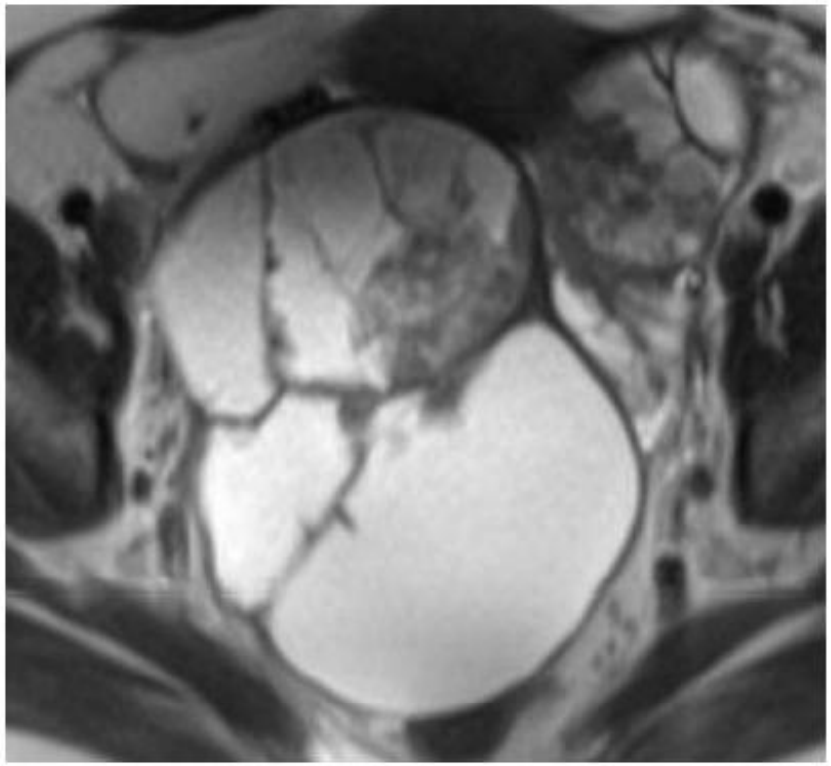
Presence of **thick irregular walls , thick septations , solid internal pappilary projections and large soft tissue components with necrosis – indicative of malignancy.**

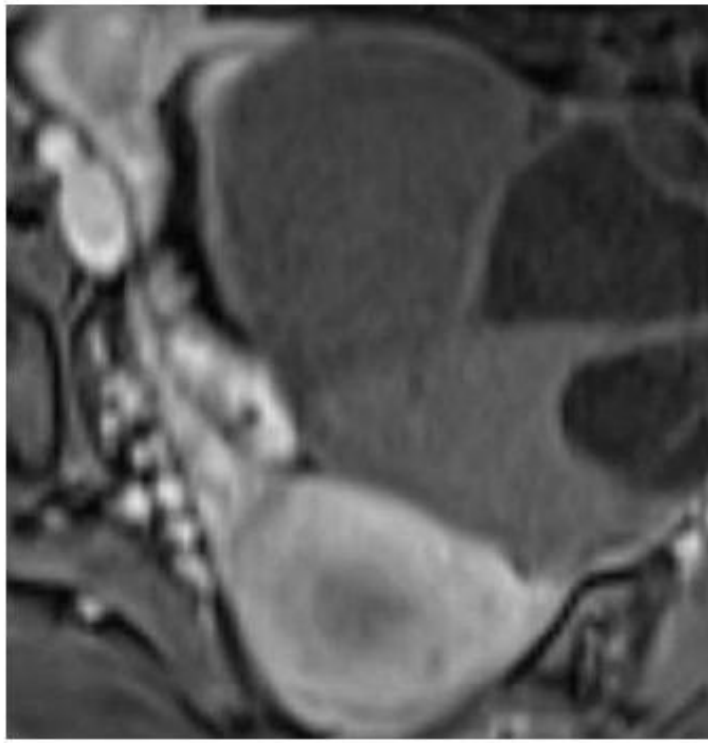
Mucinous- more of unilateral , larger at presentation, borderline or malignant at presentation.

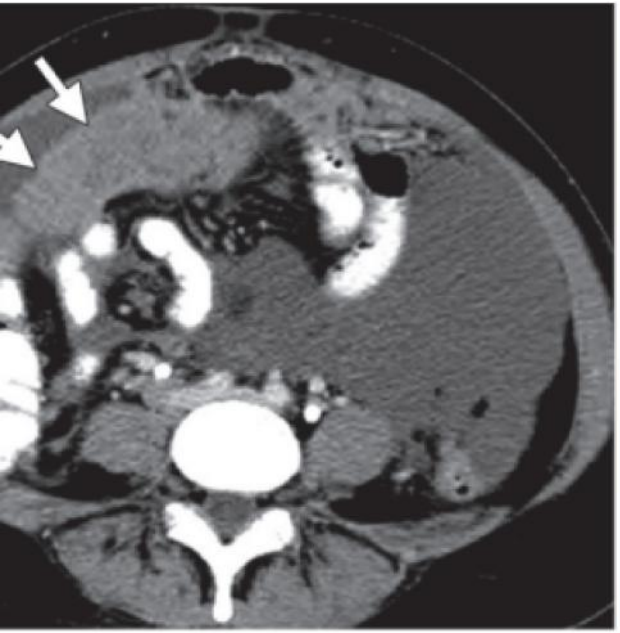
Multilocular with mucoid material – INCREASED DENSITY OR INCREASED T1W signal and decreased T2 Weighted signal compared to watery mucin-STAINED GLASS APPEARANCE.

PSEUDOMYXOMA PERITONEI – implants of mucinous tumor on peritoneal surfaces.









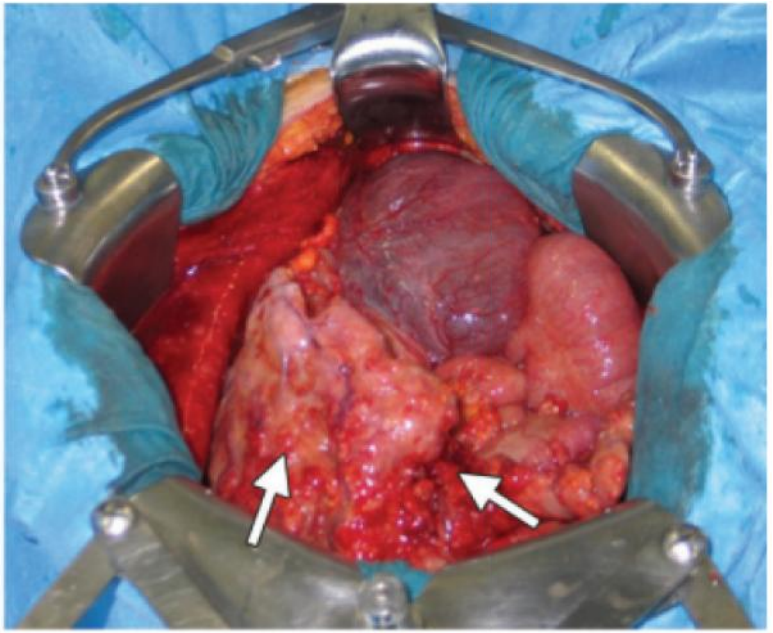


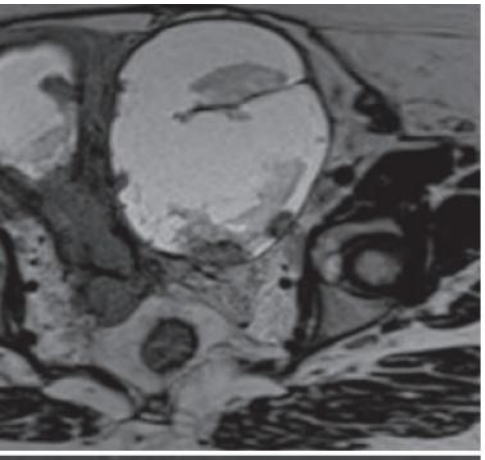
FIG 57-26 "Stained glass" appearance of a mucinous c
In contrast to a serous cystadenoma, this multilocular m
strates varying signal intensity within different locules on
images, corresponding with varying amounts of mucin. Th
and lack of internal solid papillary projections are consi
benign neoplasm. (©Cox KL, et al: MR findings in cystic ov

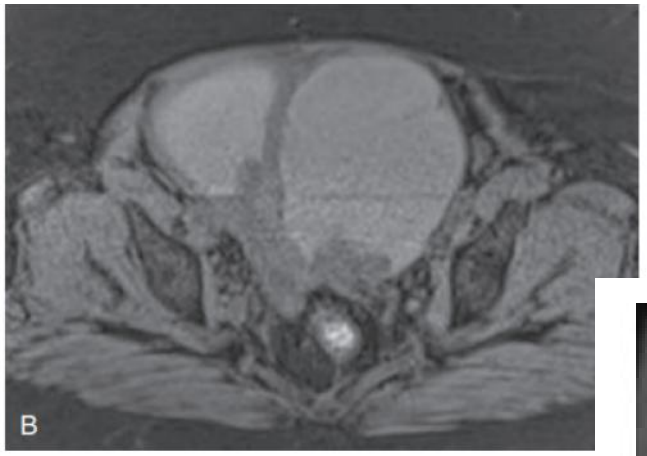
DOMETROID - Most common malignancy arising within a endometrioma.
sociated with synchronous endometrial hyperplasia or carcinoma.

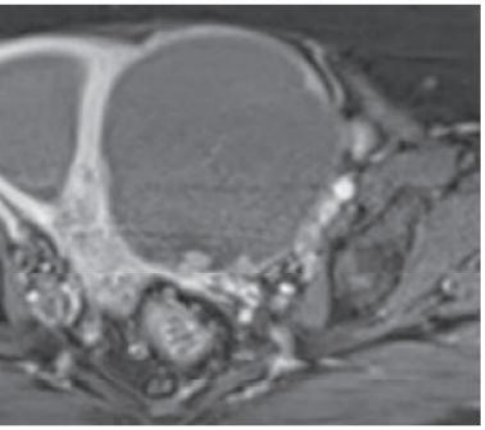
EAR CELL CARCINOMA- 2nd most common malignancy in endometriosis.
rge smooth walled unilocular cyst with solid internal projections. – LOW
ALIGNANT SEROUS TUMOR IN DIFFERENTIALS.

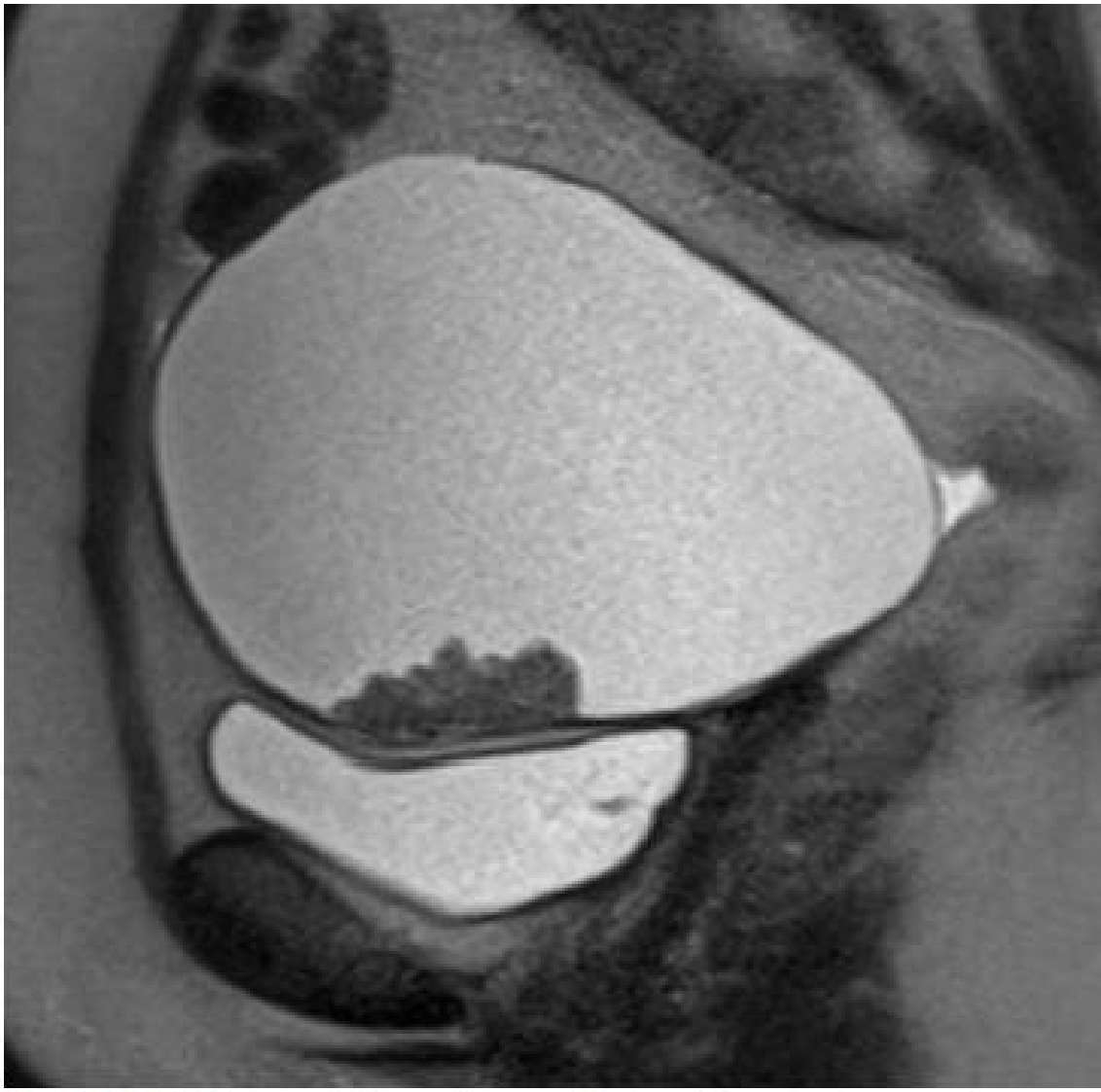
RENNERS – dense stroma + transitional cells

her multilocular cystic mass with solid component or predominantly soli
ass. EXTENSIVE CALCIFICATION within the solid component is present.




B





GERM CELL TUMORS OF OVARY :

MATURE TERATOMA- most common benign malignancy. Unilocular mass illed with sebaceous material and lined by squamous epithelium.

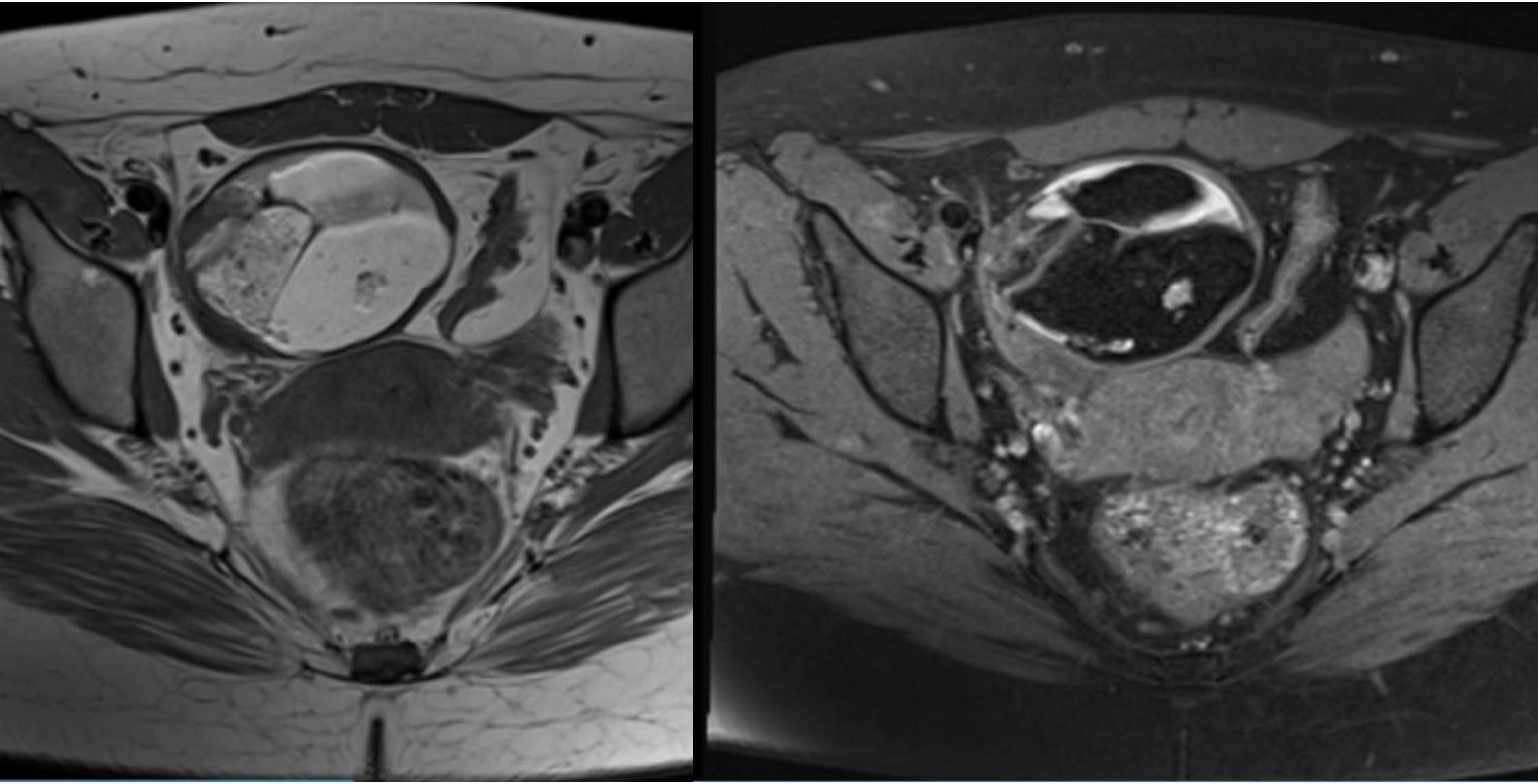
CT – FAT ATTENUATION WITH OR WITHOUT CALCIFICATION WITH A CYSTIC ESION

MRI – lipid laden sebaceous component demonstrate **increased signal in T1WI and intermediate signal in T2WI.**

Features of malignant lesion – age >45 yrs , tumor >9.9 cm , elevated CEA evel. *ROKITANSKY NODULE is a common site of malignant transformation*

MMATURE TERATOMA - common in first two decades of life and very larg t diagnosis (15-25 cm).

Presents with large solid components , cystic areas and intramural fat.



YSGERMINOMA : younger than 30 yrs

&MRI – unilateral multilobulated solid masses with prominent fibrovascular ptae. Low signal on T1W and intermediate signal in T2W with enchancing rovascular septae.

may demonstrate speckled calcification.

IDODERMAL SINUS TUMOR – large cystic and solid mass with components tending into abdominal cavity. Elevated AFP levels.

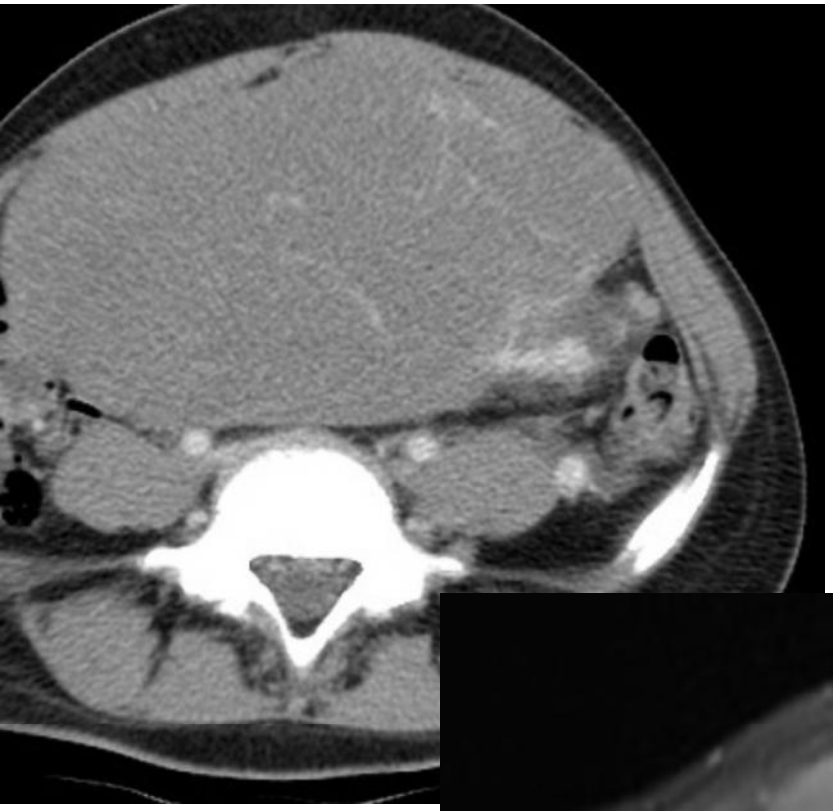
X CORD STROMAL TUMORS:

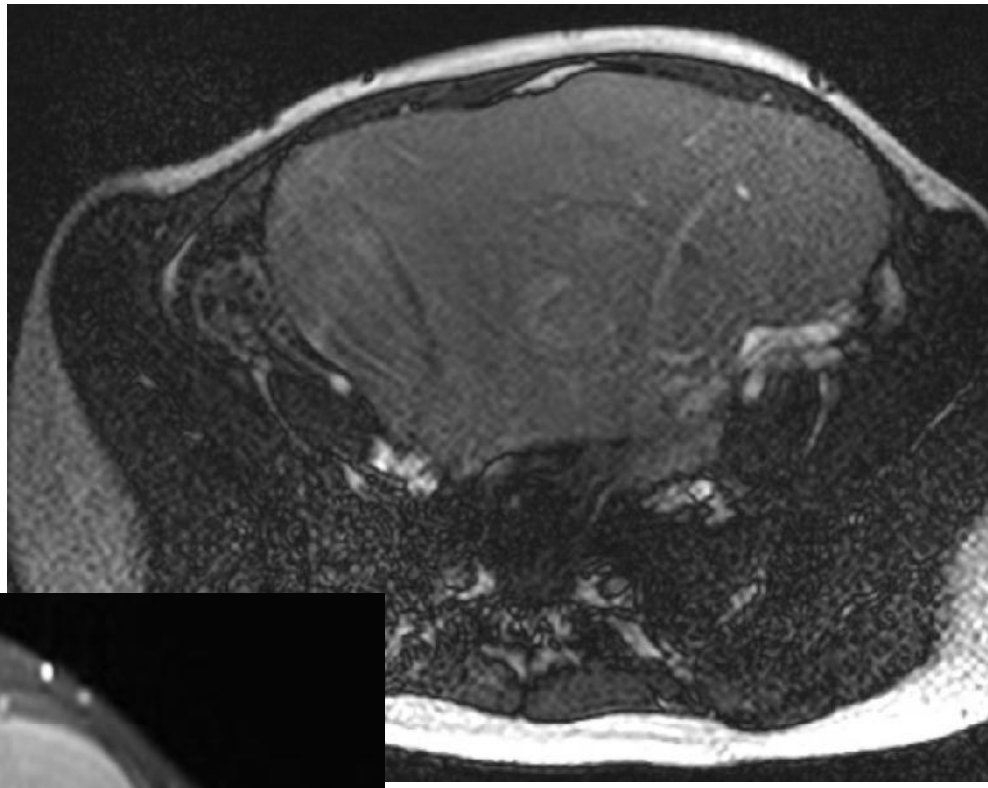
BROMA, FIBROTHECOMA and THECOMA – composed of varying degrees of roblasts and spindle cells.

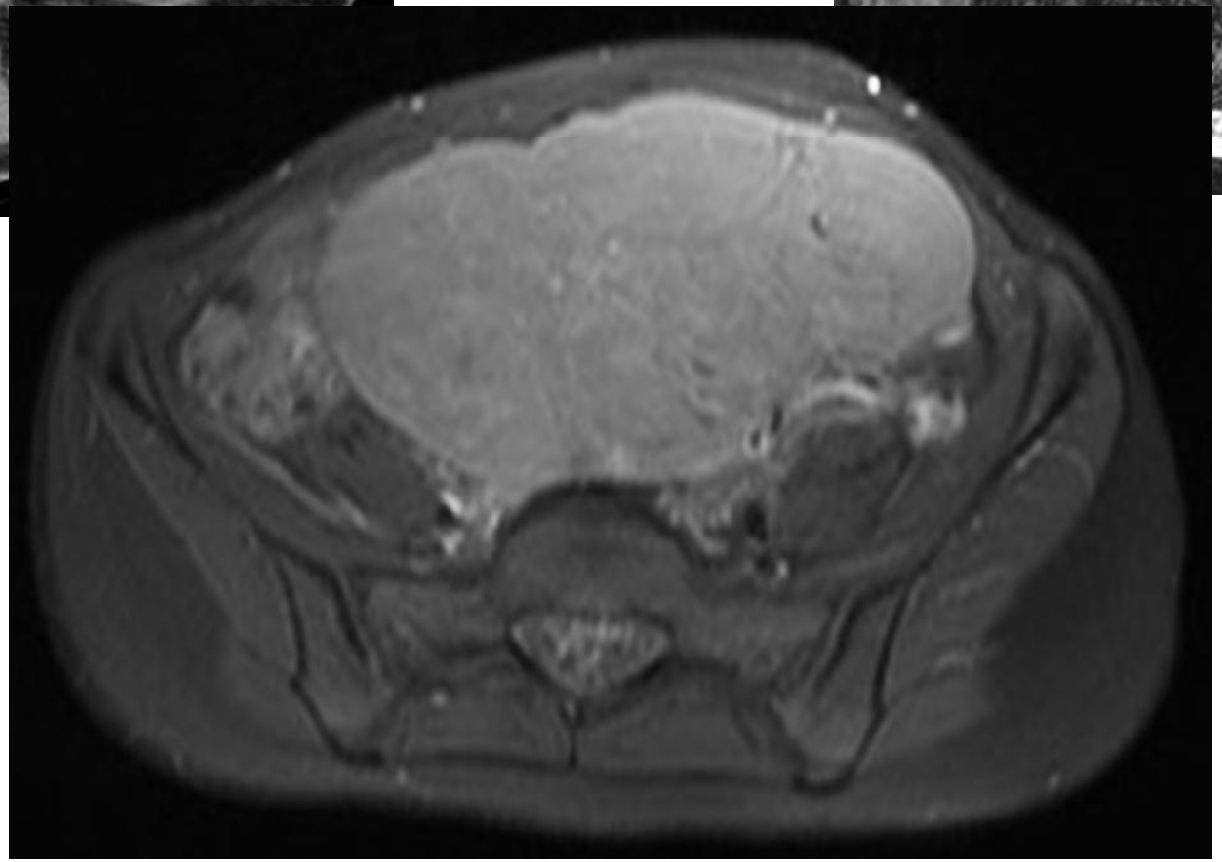
RANULOSA CELL TUMORS – estrogen secreting tumors – precocious puberty

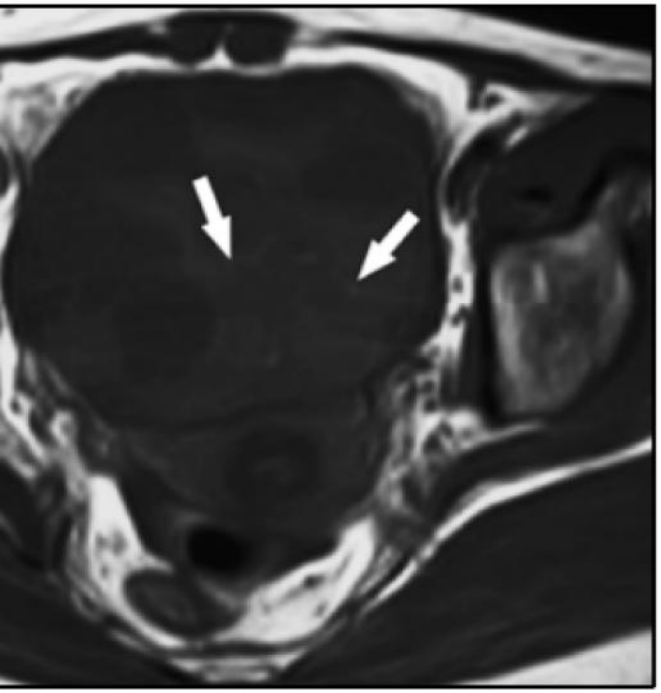
&MRI – widely varying-> completely solid mass , hemorrhagic masswith fibrot anges , a multilocular cystic mass or completely cystic mass.

fferent from epithelial tumors – do not have intratumoral papillary projections d les likely to seed peritoneum.

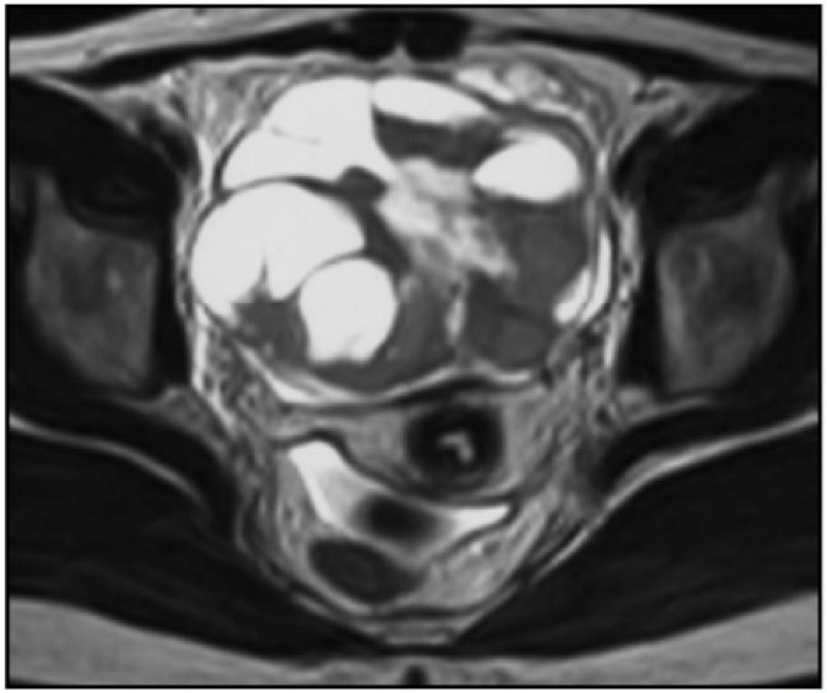




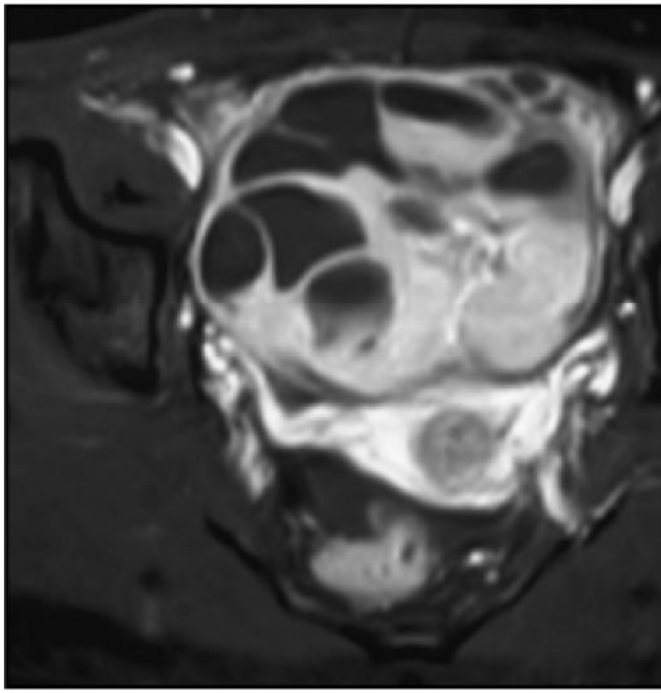




A



B



year-old woman with granulosa cell tumor.

LEROSING STROMAL TUMOR: Benign neoplasms, menstrual irregularities mmon presentation.

IAGING – large mass with hyperintense cystic components and terogenous solid component with intermediate to high T2 signal .

hancement pattern similar to hemangiomas- Early peripheral enhancemer th centripetal progression. (differentiating from **delayed enhancing broma).**

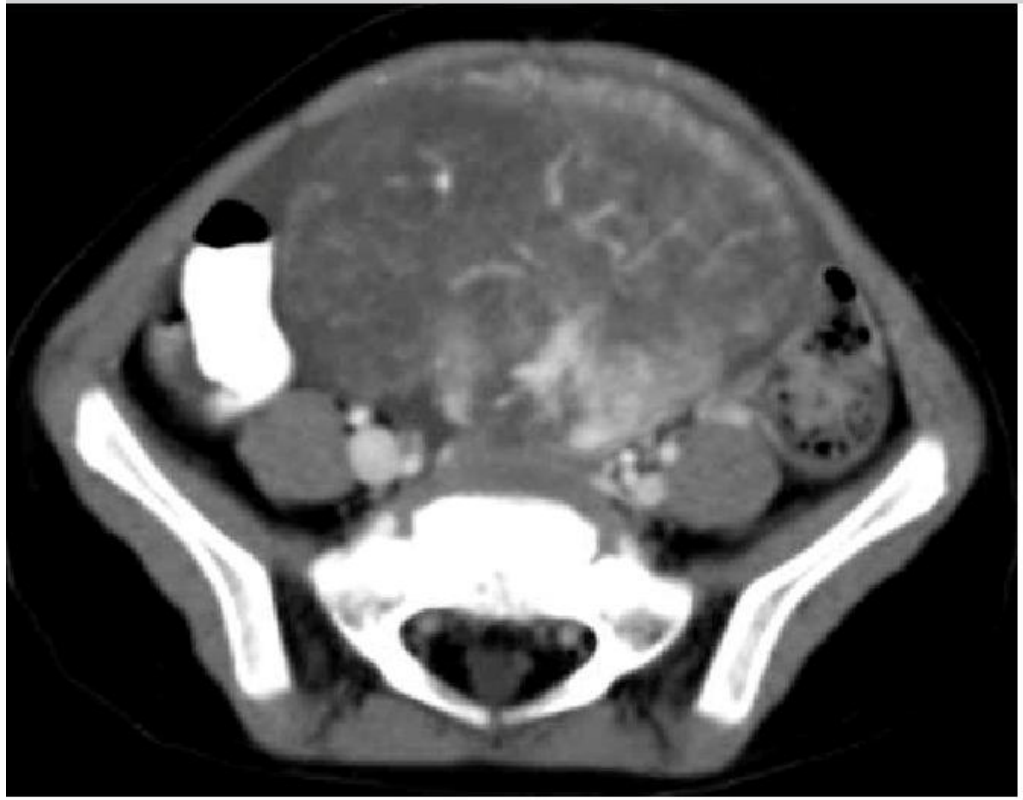
RTOLI LEYDIG CELL TUMORS : Most common virilising ovarian neoplasm

ung women with androgenic activity.

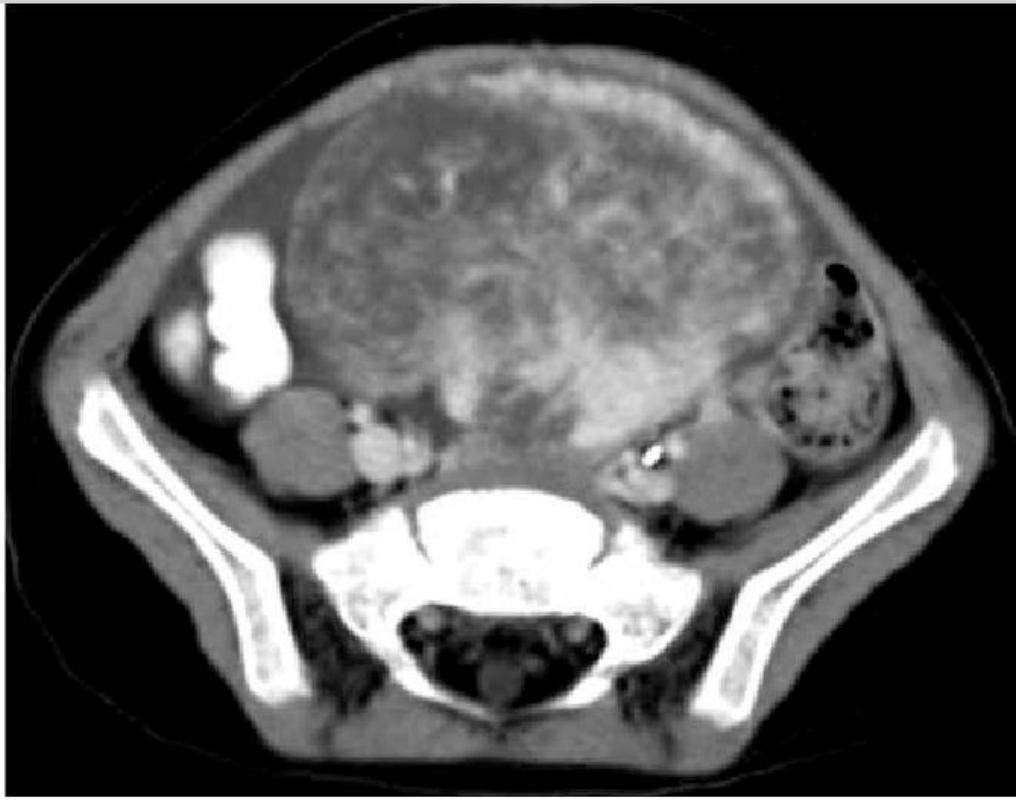
nilateral, solid enhancing mass with intratumoral cysts – common esentation.

w signal on T2WI corresponding to degree of fibrous stroma.

Figure 2



2a



2b

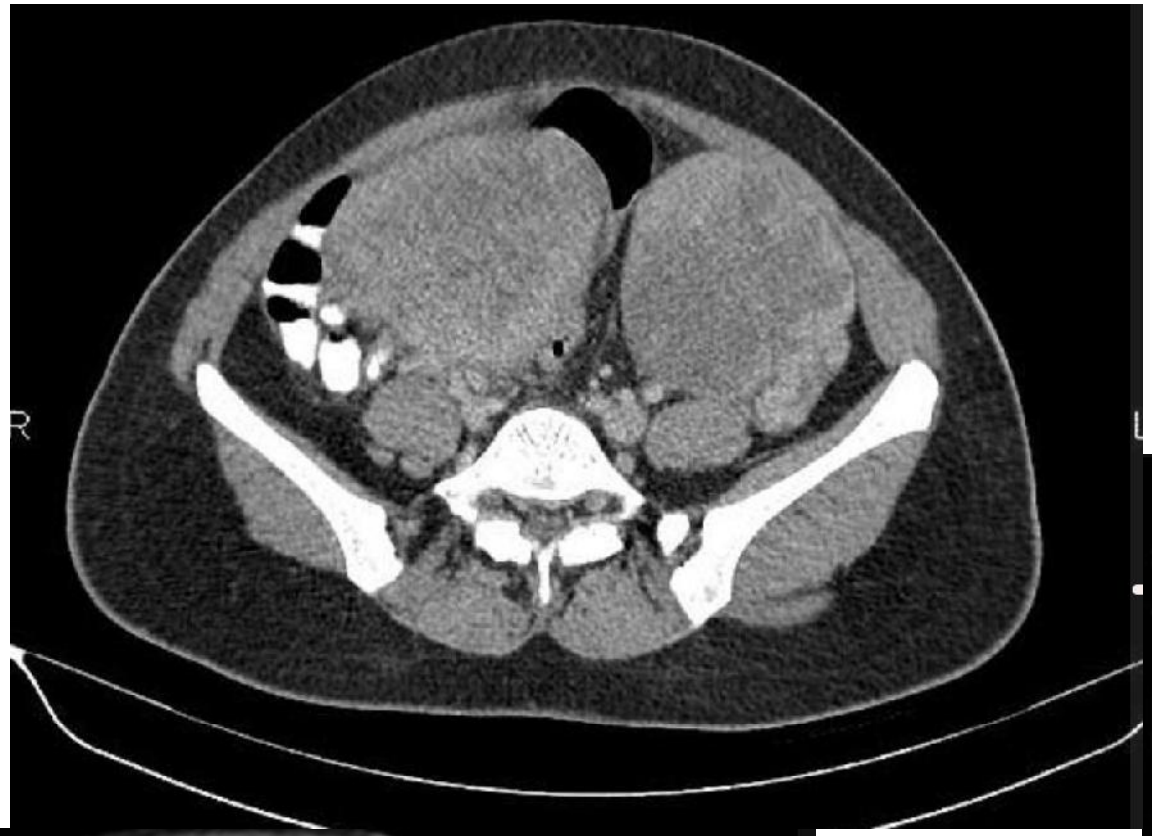
KRUKENBERG TUMORS

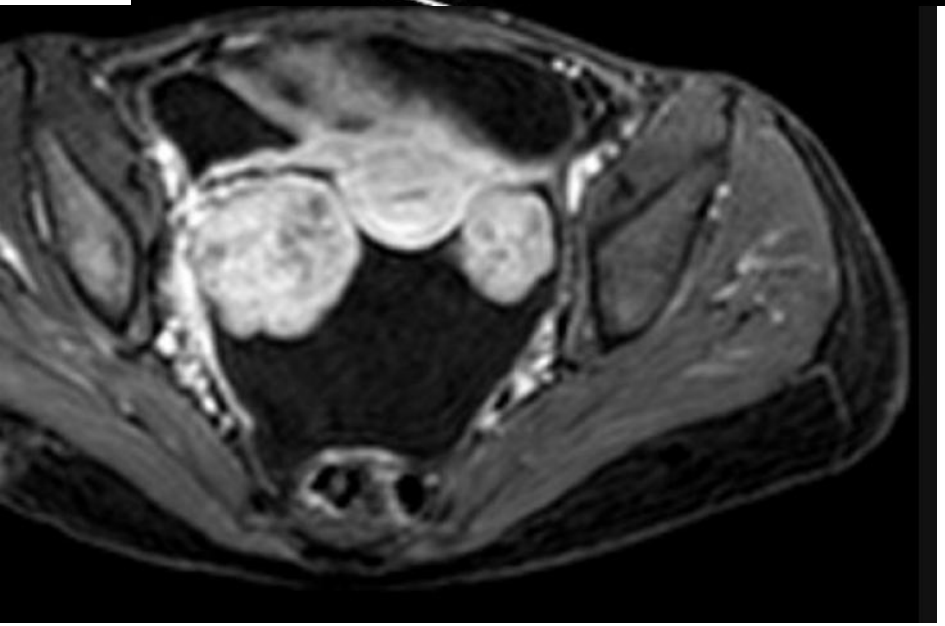
Bilateral in 75% cases.

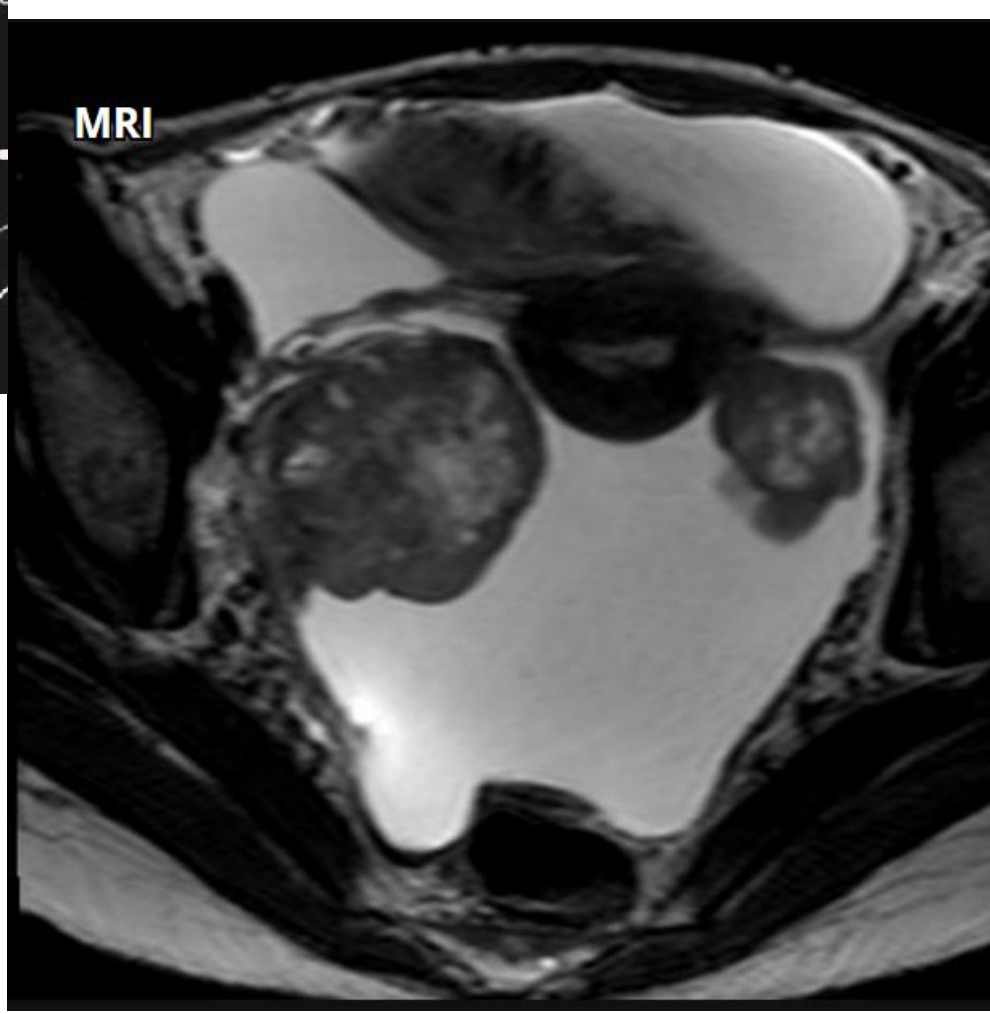
From colon, stomach and breast.

Bilateral ovarian masses tend to preserve ovarian contour.

Hypointense solid components on T1WI secondary to Dense stromal reaction and internal hyperintensity on T2WI secondary to mucin

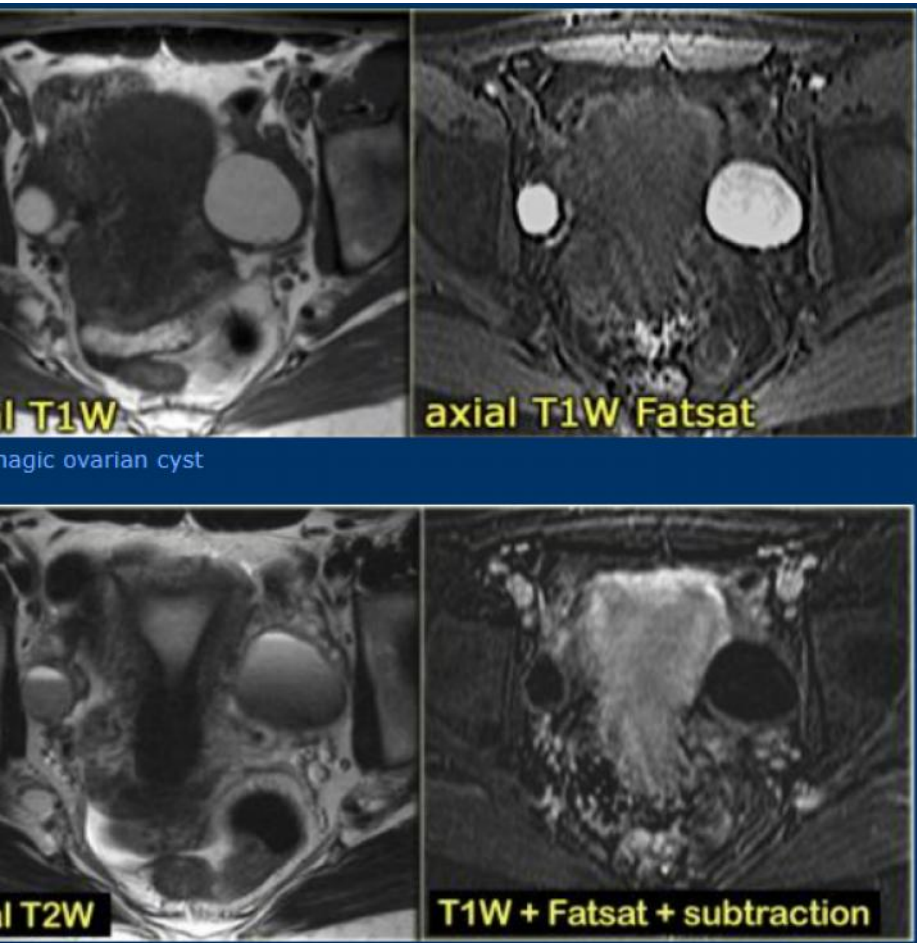


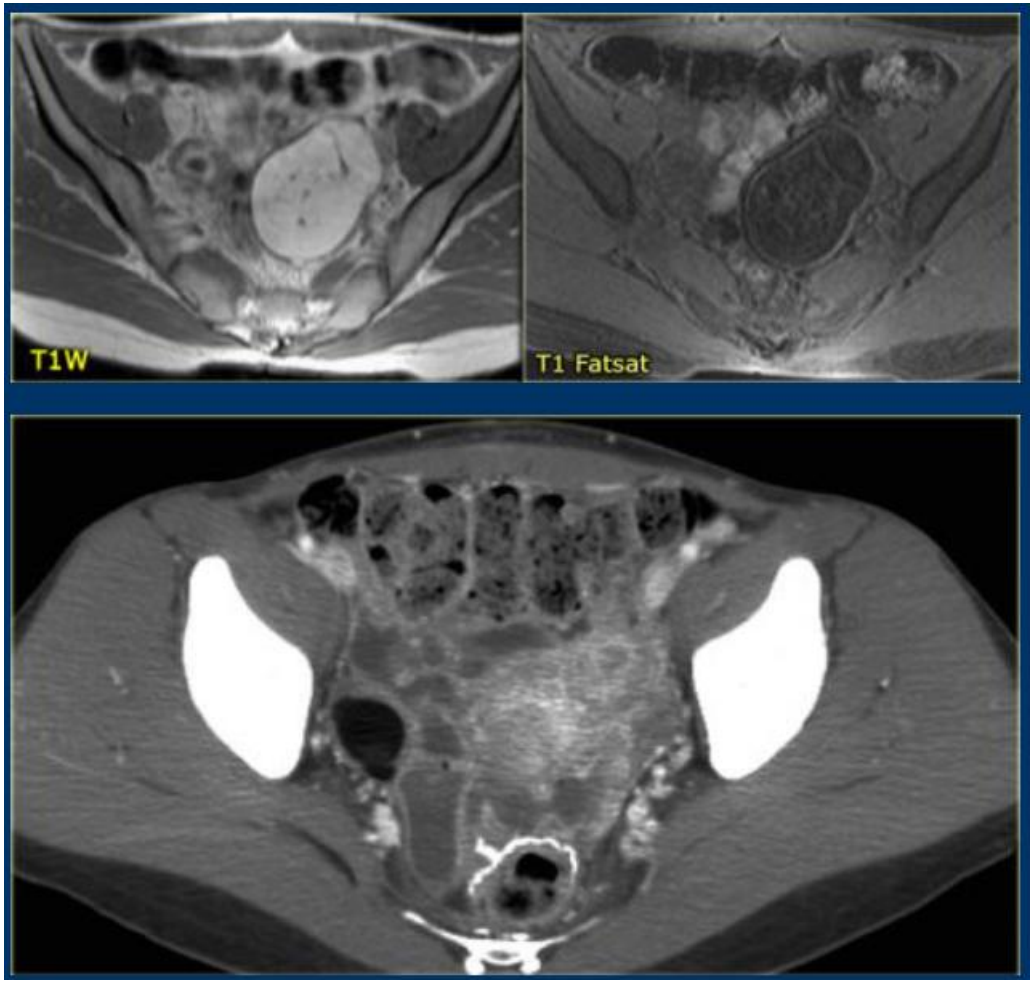



MRI

CONCLUSION

MORRHAGIC CYST VS DERMOID





LEIOMYOMA DEG VS SACROMA

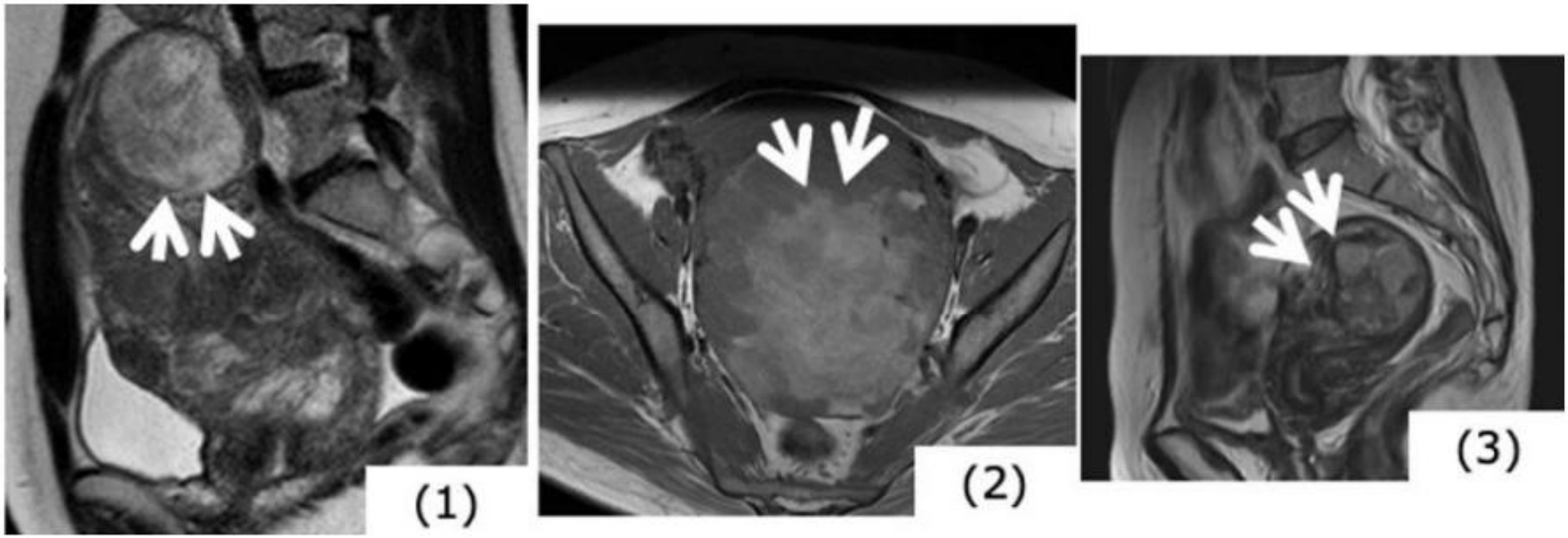
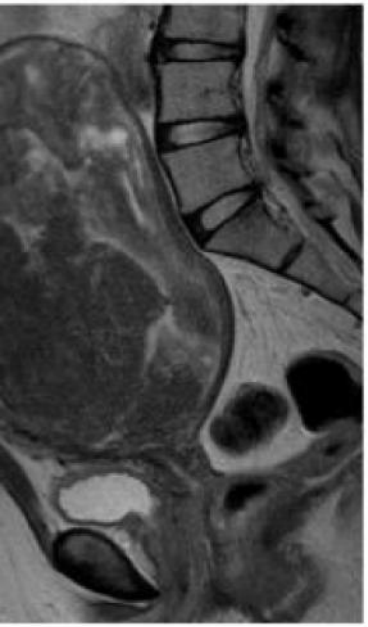
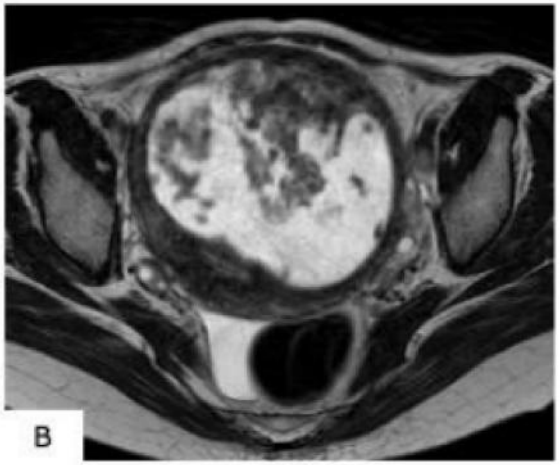
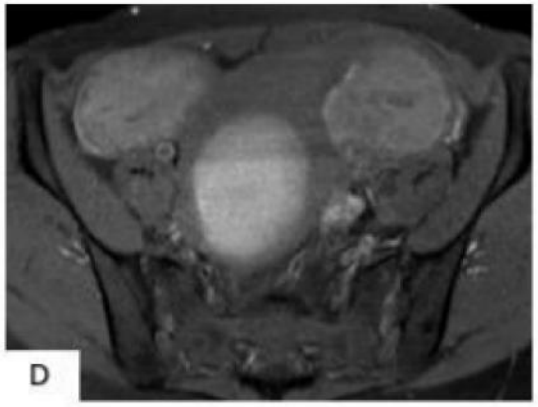
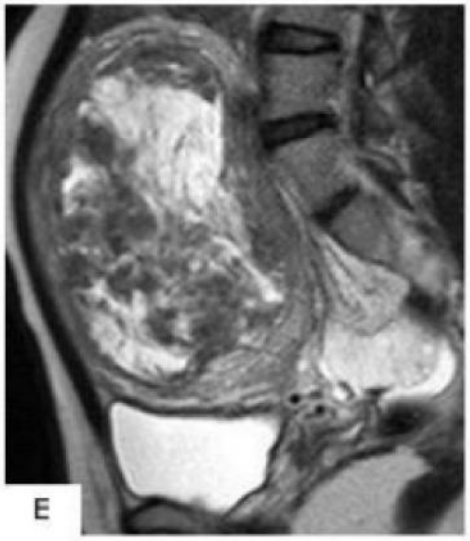


Figure 3. Magnetic resonance image findings considered to be characteristic of (specific for) uterine sarcoma. (**1**) High signals in T2-weighted images (T2WI) (case of uterine myoma): Mass in the fundus uteri has extremely high signal intensity (SI). (**2**) High signals in T1-weighted images (T1WI) (case of uterine sarcoma): There are mottled portions of high SI suggesting hemorrhage within the mass. (**3**) Ill-defined mass borders (case of uterine sarcoma, T2WI): Mass existing in the myometrium. High signals are presented in T2WI, and at the arrow portions, borders are ill-defined.

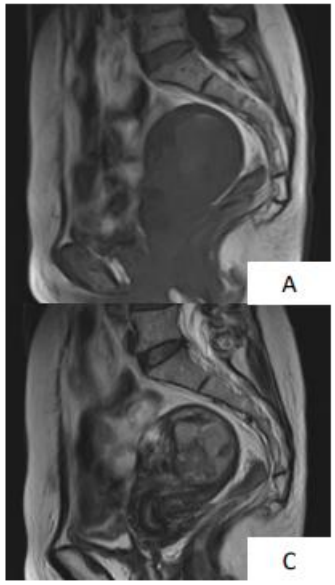




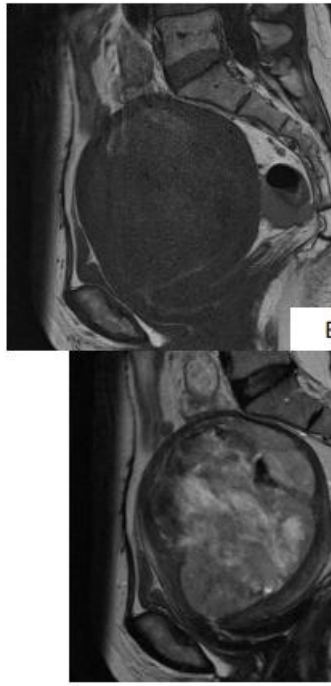




MR images of degenerated leiomyoma. These images always require a differential
coma. (**A**): hyaline degeneration (T2WI), (**B**): leiomyoma with cystic change (T
eiomyoma (T2WI), (**D**): red degeneration (T1WI), (**E**): myxoid degeneration (T2WI)



⇒
1 year after



When to decide between CT and MRI ????

CT OVER MRI :

Follow up cases

Nodal stations

Cost

Extrapelvic disease involvement

MRI:

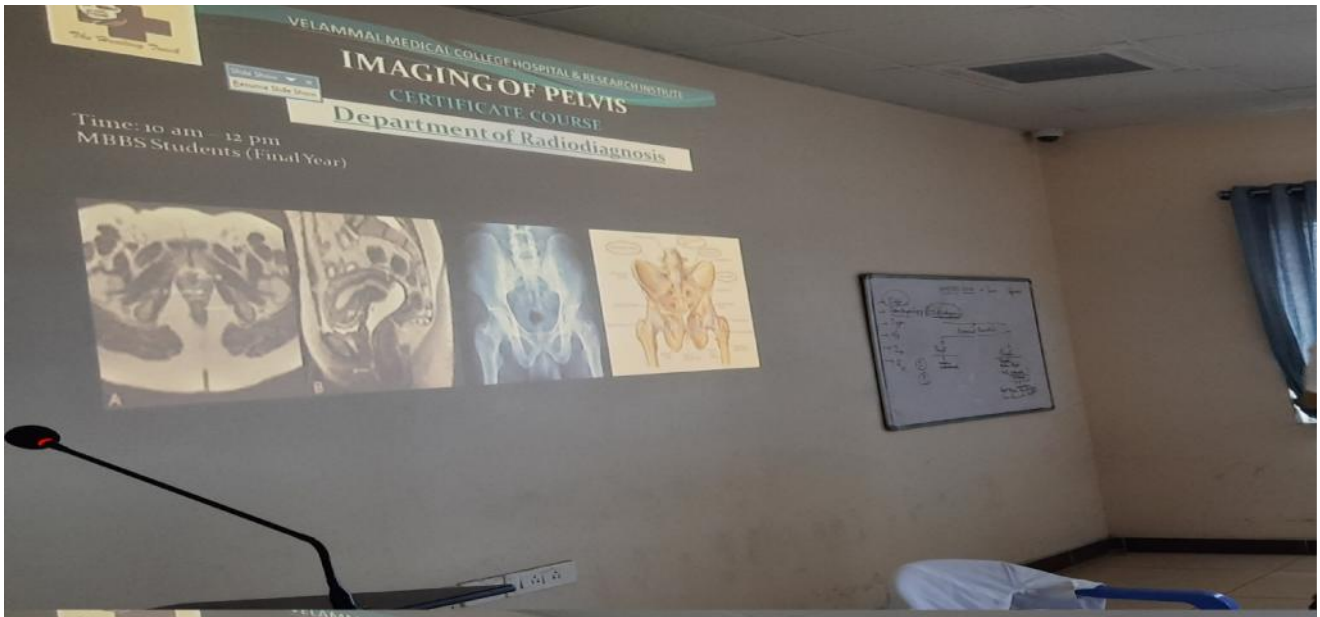
Congential anomalies

To known origin of pathology

Extend and local staging of tumors

Chacracterisation of cysts

Benign vs malignant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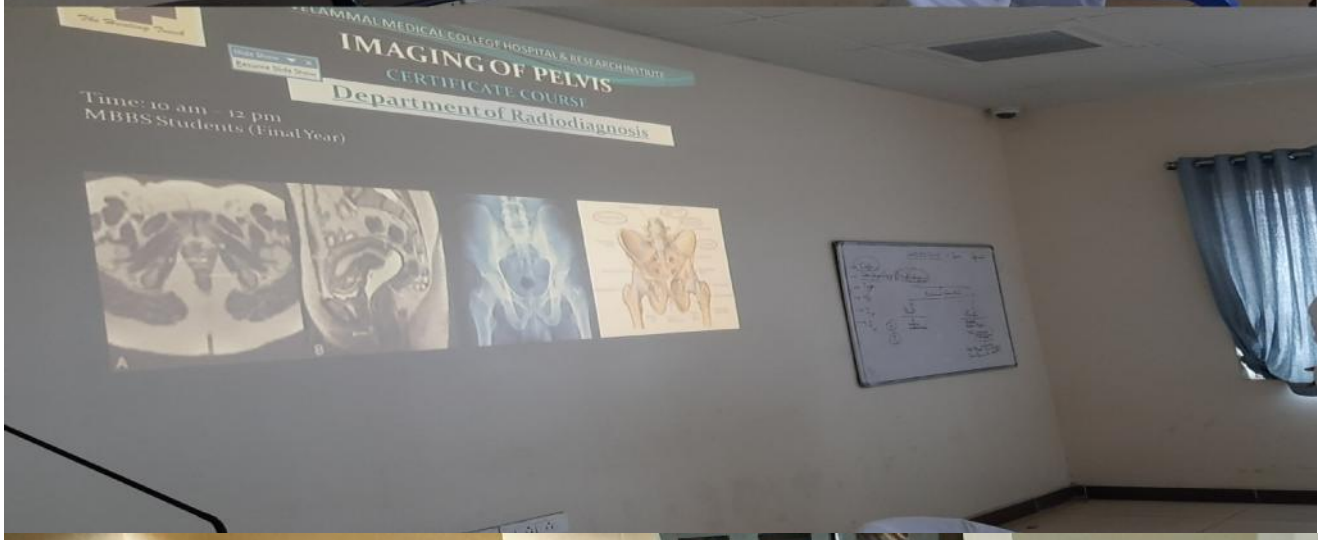
IMAGING OF PELVIS
CERTIFICATE COURSE
Department of Radiodiagnosis
Time: 10 am – 12 pm
MBBS Students (Final Year)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