

# **Basic Ultrasound Training including the hand-on practice**

# Ultrasound

- Audible sound (20-20000Hz)
- 1 Hz 1000000 MHz
- Sound speed 1540 meter/sec
- Using sound wave between  
1 to 30 MHz

# **Why you should learn basic Ultrasound whatever you are a Doctor or Administrator**

- (1) Profitable Investment
- (2) No special consumable product (e.g. Gel)
- (3) Wide range of Diagnosis
- (4) Rapid Diagnosis
- (5) No biological hazard

# Basic Ultrasound Configuration & Function

- (1) Picture
- (2) Power Supply (Ac or Battery )
- (3) Console
- (4) Printer

# Picture



## Power Supply (Ac (or) Battery )



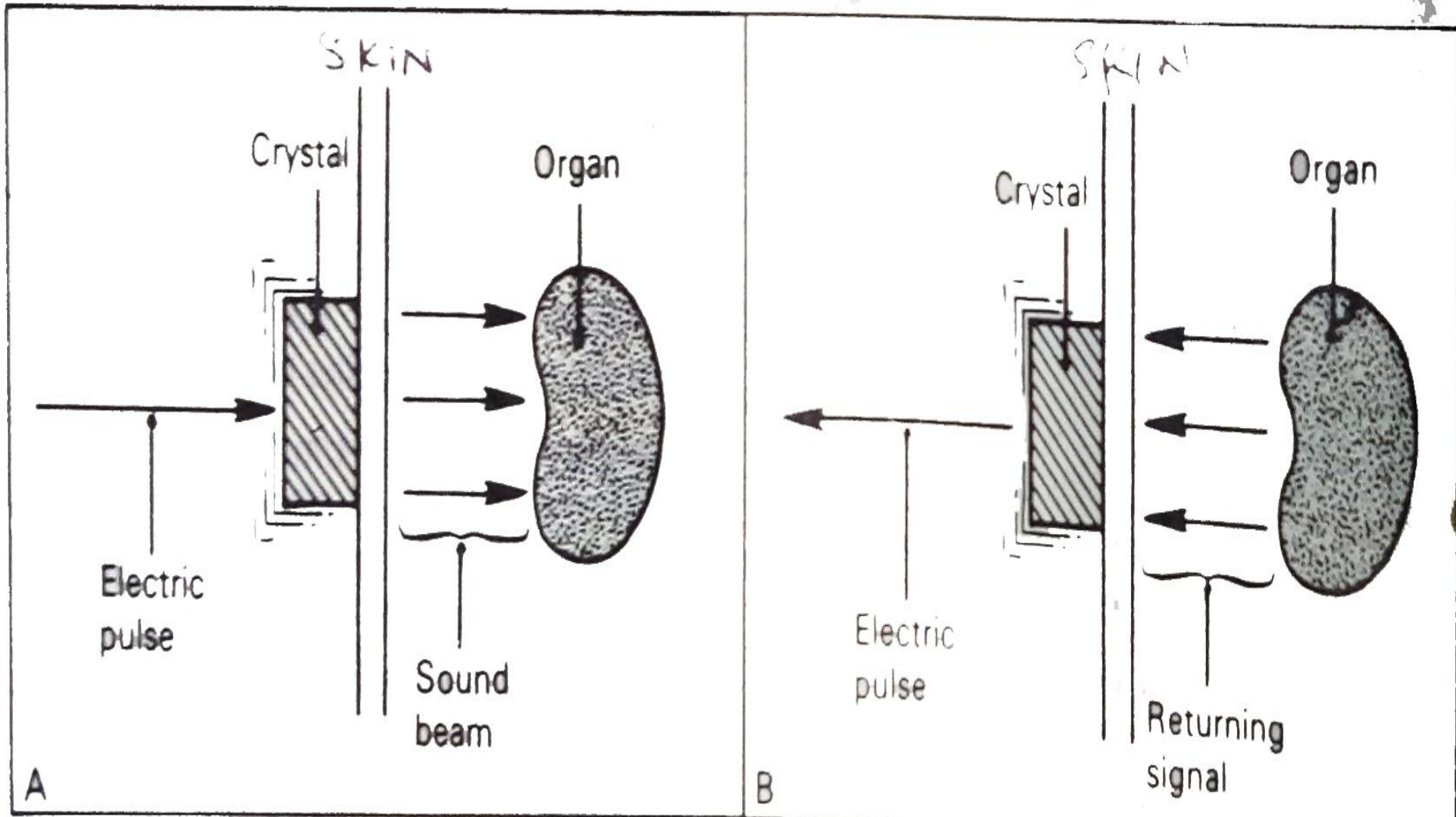
# Console



# Printers



# The pulse-echo principle



# Type Of Ultrasound

- (1) Mobile Type
- (2) Portable Type
- (3) Invasive Type

Trans esophageal, trans arterial

# Mobile Type



# Portable Type



# Invasive Type



# Tee Prove



# Design of Transducer (Probes) & Frequency Range

## Convex



# Linear

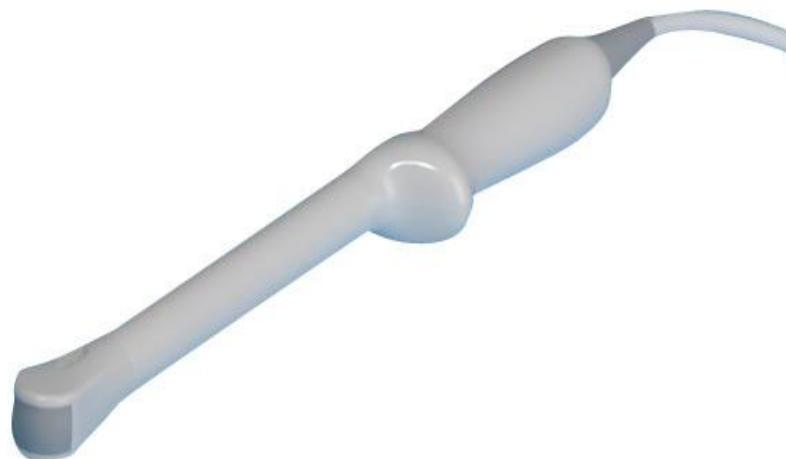


# Sector/Cardiac



# Endocavity

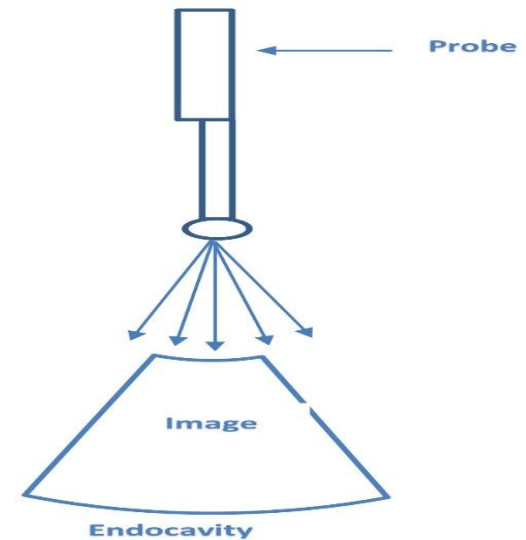
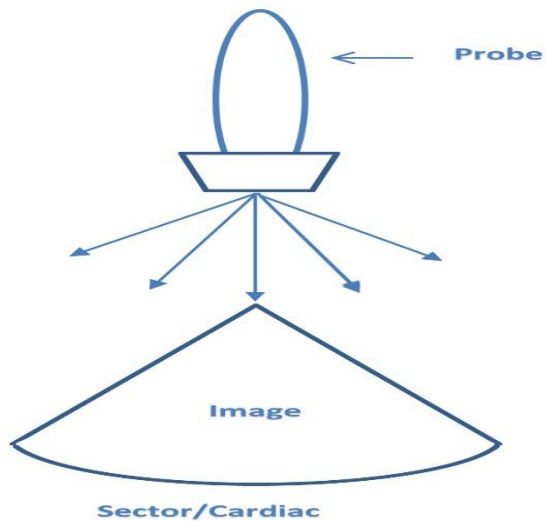
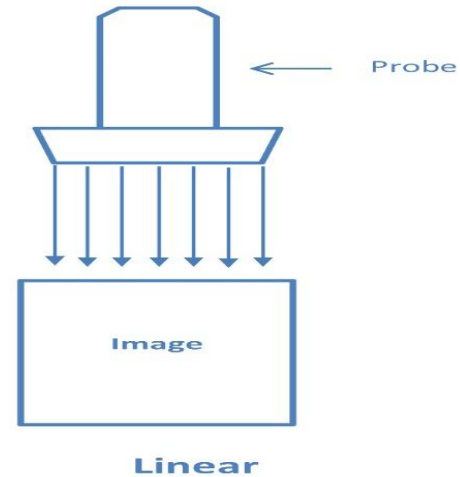
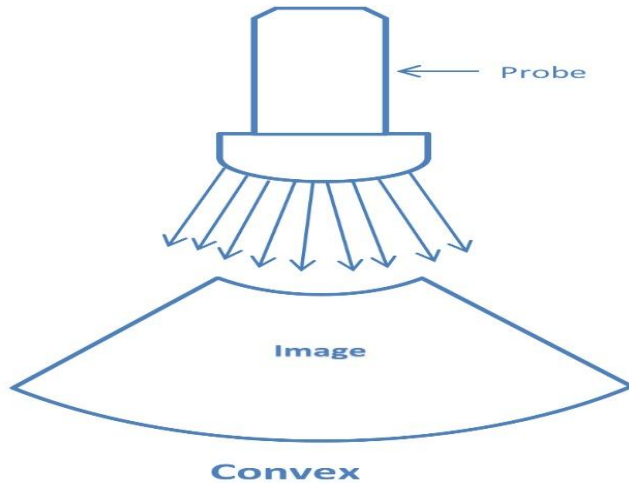
(Transvaginal, Transrectal, Introperative)



# Tee Prove



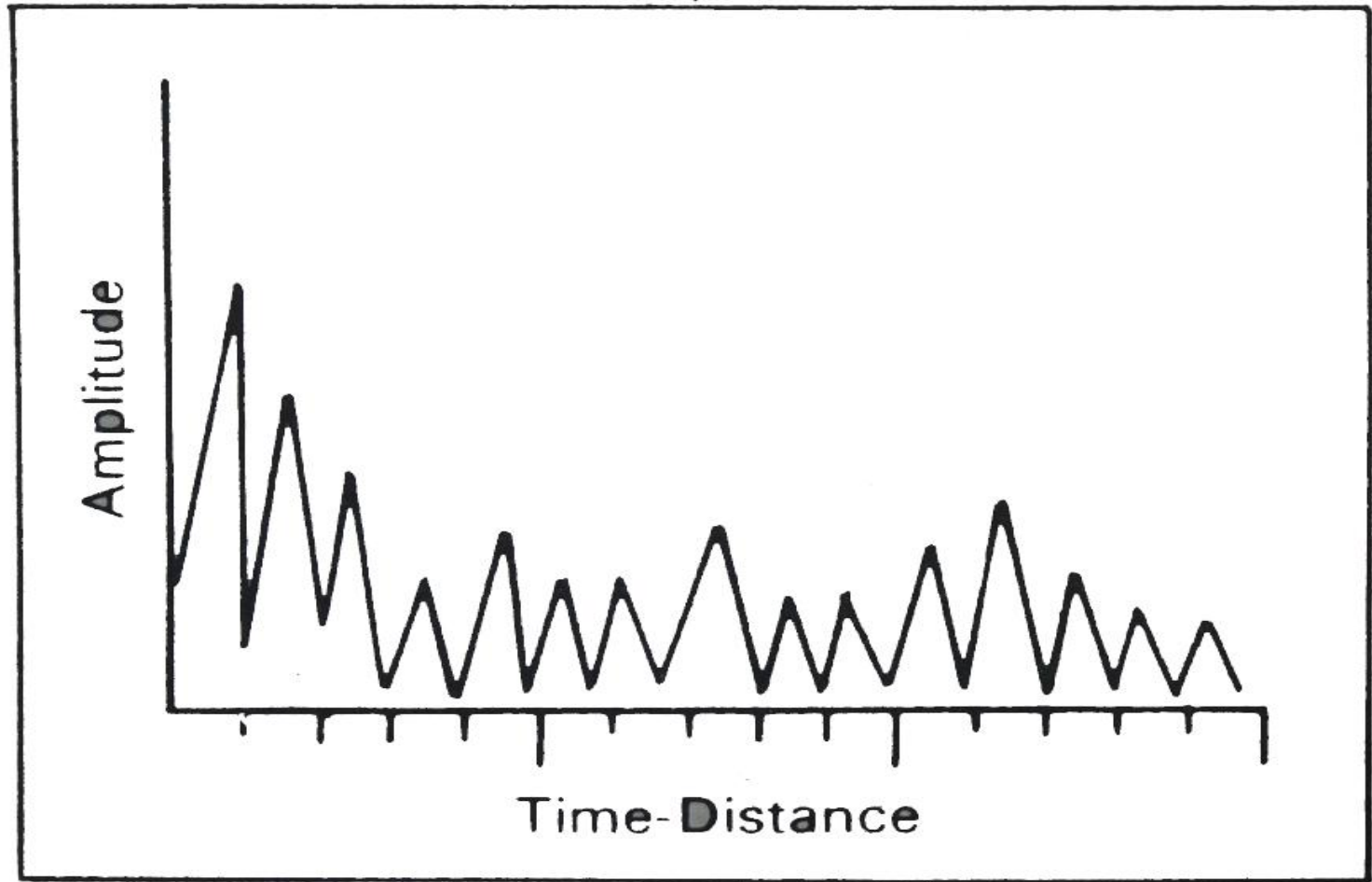
# Transducer Design, Sound Wave & Image Relationship



# Ultrasound Function

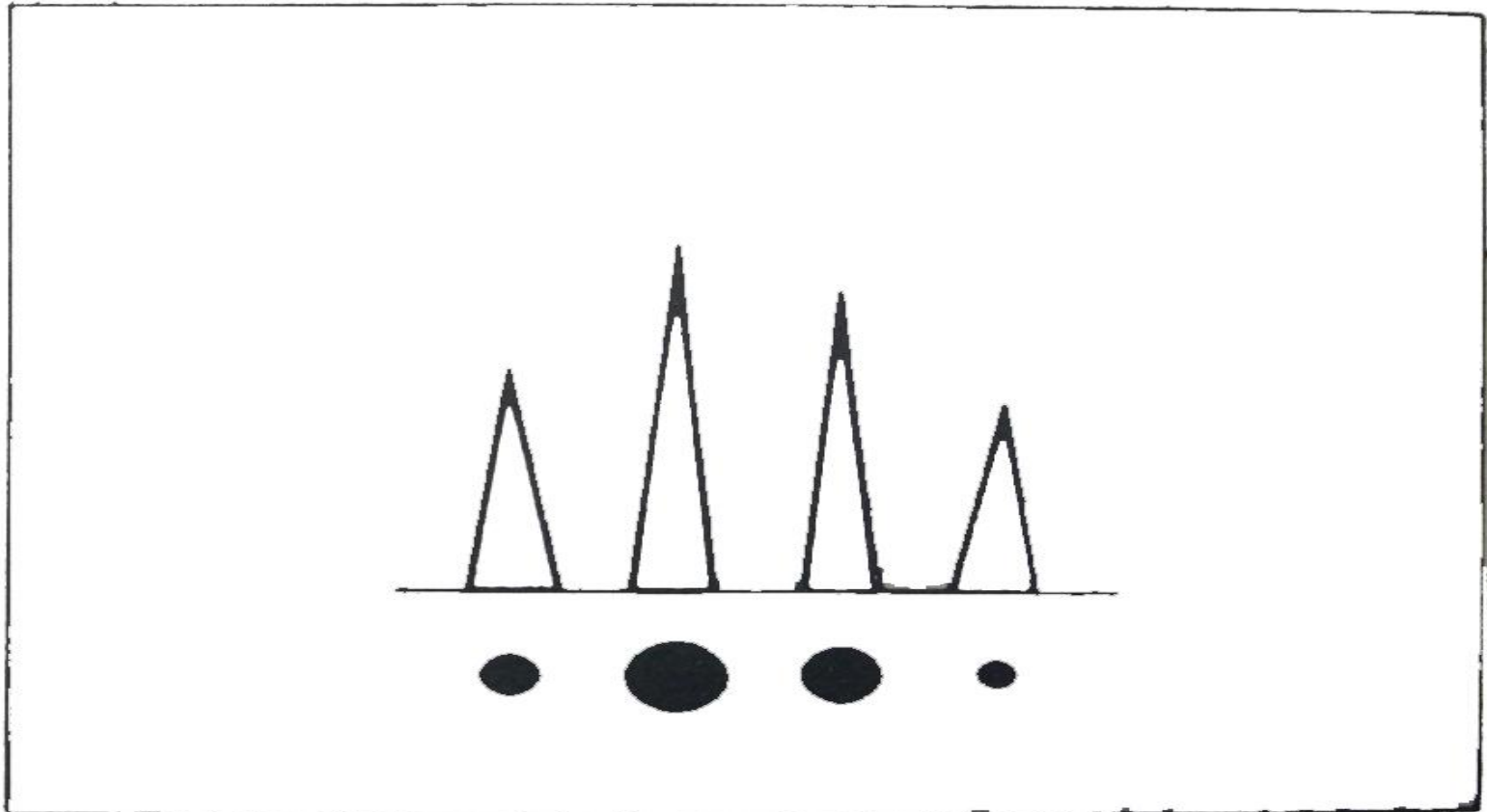
- 1. Monitor Resolution Adjustment**
- 2. Console Buttons**
  - Selection of Transducer
  - TGC Gain Adjustment
  - 2D Gain Adjustment
  - A Mode, B Mode, M Mode
  - Measurement Software select in Preset
  - Depth and Zoom
  - Freeze
  - Measurement
  - Comment
  - Print (P)
- 3. Double or Quadrant Picture, Reverse, Upside down function**
- 4. Color Flow (CF), Pulse Wave (PW), Continuous Wave (CW), Tissue Doppler Image (TDI), THI**
- 5. 2D, 3D, 4D**

# A mode



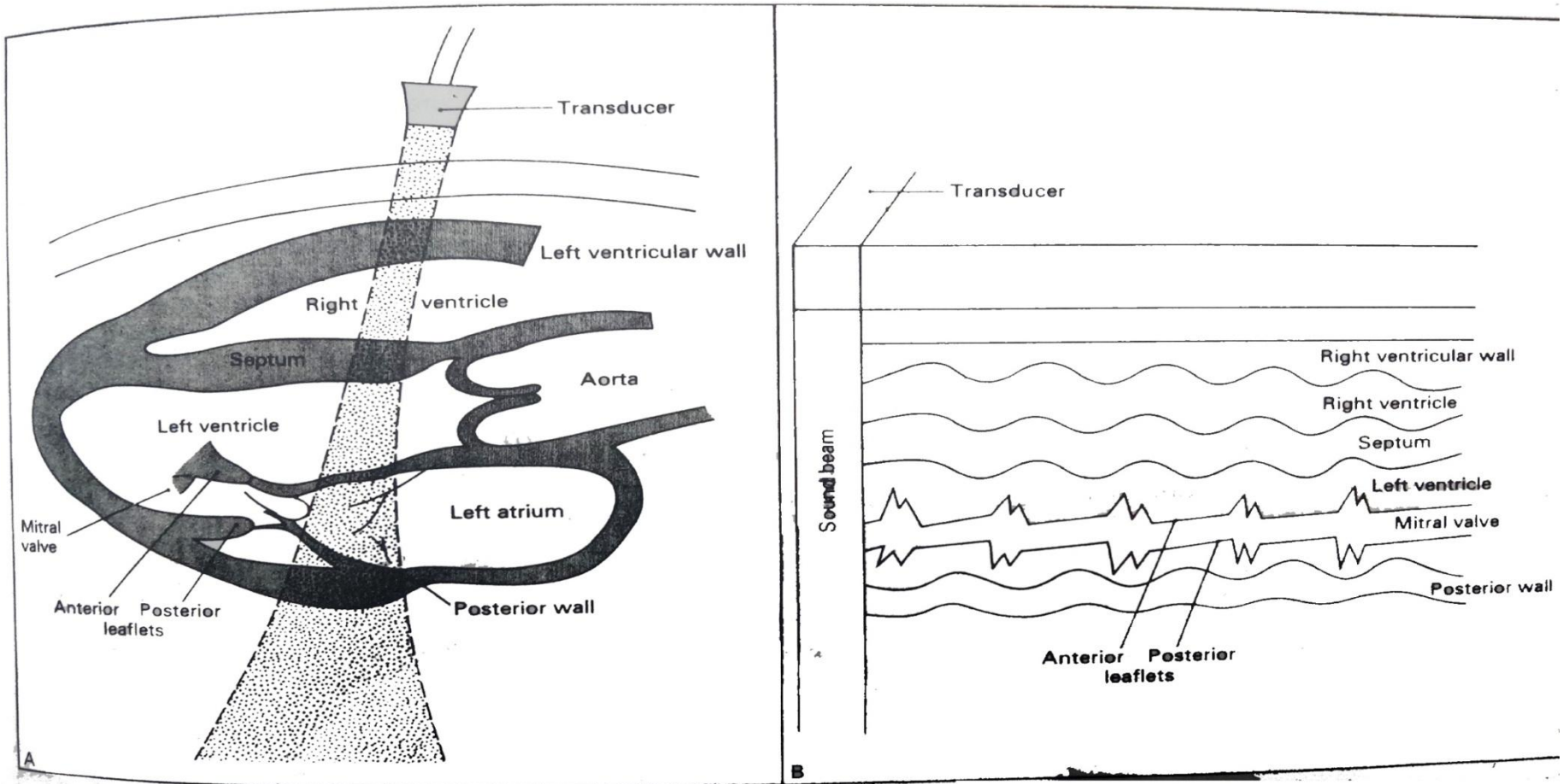
A-Mode display. The strength of the acoustic interface is shown by the size of the echo.

# B mode



The amplitude of an echo is displayed as the brightness of a dot comparable to the echo strength on the A-mode display

# M mode



A Diagram demonstrating the sound beam angled through specific heart structures. B The M-Mode read-out of those structures within the sound beam

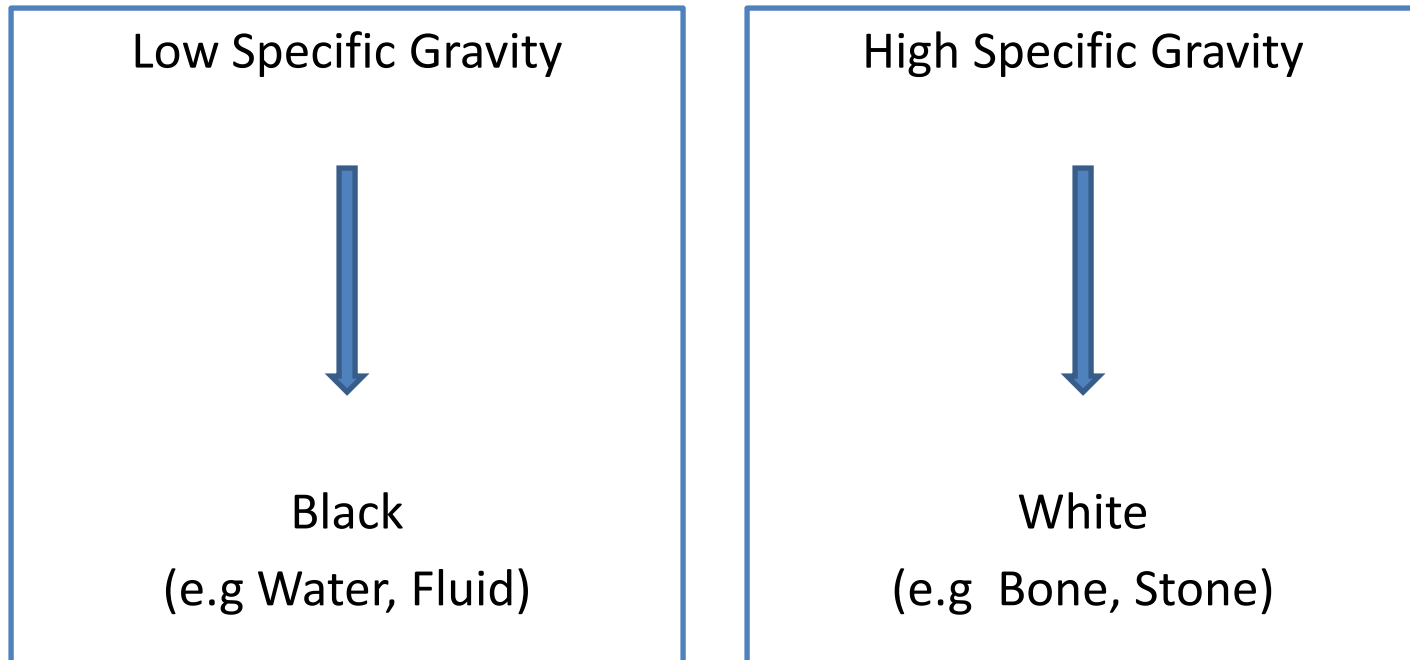
# Gain

- (1) Coarse gain (2D)
- (2) TGC (Time Gain Compensation)

# CF (Colour Flow)

- (1) BART (Blue Away, Red Toward)
- (2) Intensity is adjustable.

# Image Resolution



# Pulse Wave

Doppler permits accurate sampling of blood velocities averaged within a limited region of interest or 'sample volume.'

- Transducer elements serve as both transmitters and receivers, permitting selective sampling of reflected ultrasound and accurate range or spatial information.
- PW Doppler spectral displays range that can be presented by PW Doppler is limited by the Nyquist limit).

# Continuous Wave

Continuous wave (CW) Doppler involves continuous transmission of ultrasound with one transducer element while a second serves as a receiver.

- Higher sampling rates are achieved, and consequently higher velocities, such as those found in stenotic and regurgitant lesions can be measured.
- CW Doppler does not permit ranging information to be acquired and all velocities along a scan line are included in the spectral trace.

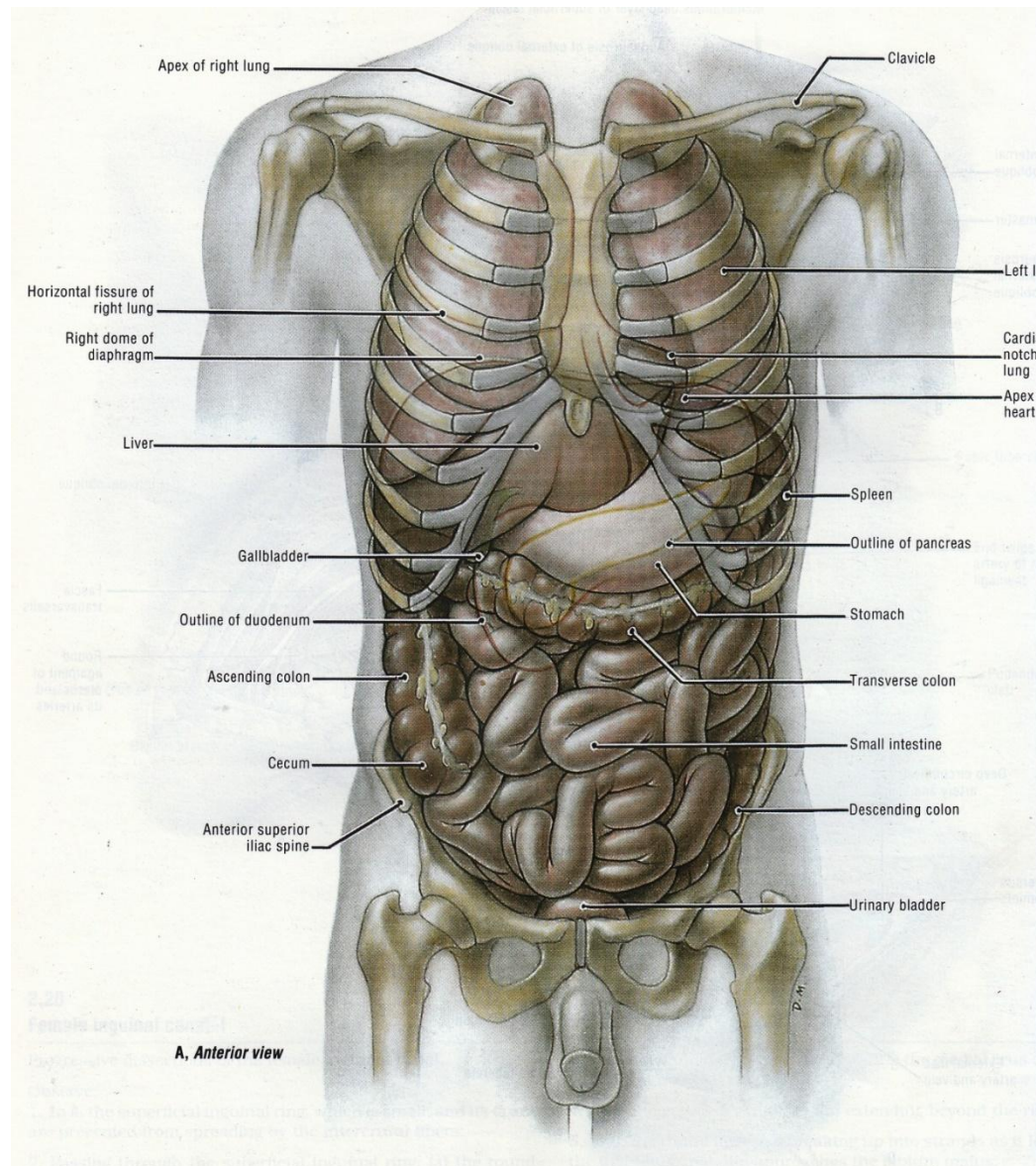
# Windows

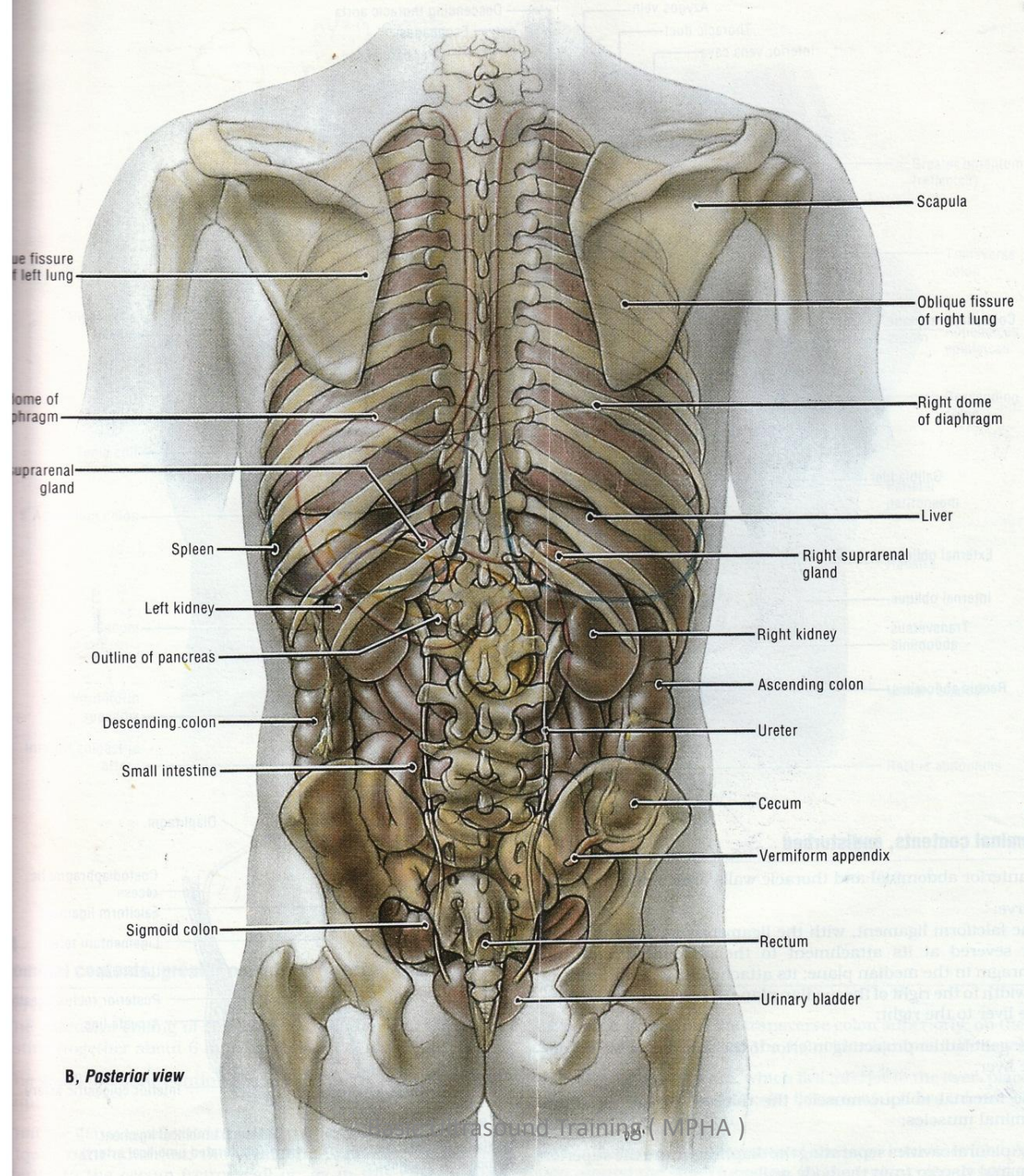
- Abdomen (Sub costal Horizontal sagittal)  
(Intercostal , Renal longitudinal + Transverse )
- Pelvis region (Sagittal + Transverse)
- Breast region (Sagittal + Transverse)
- Carouse ( Left Parasternum longitudinal +  
Transverse )( Apical 4 chamber)(Epigastric)  
( Suprasternum)(Supraclavicular)
- Thyroid (Sagittal + Transverse)

# Measurement

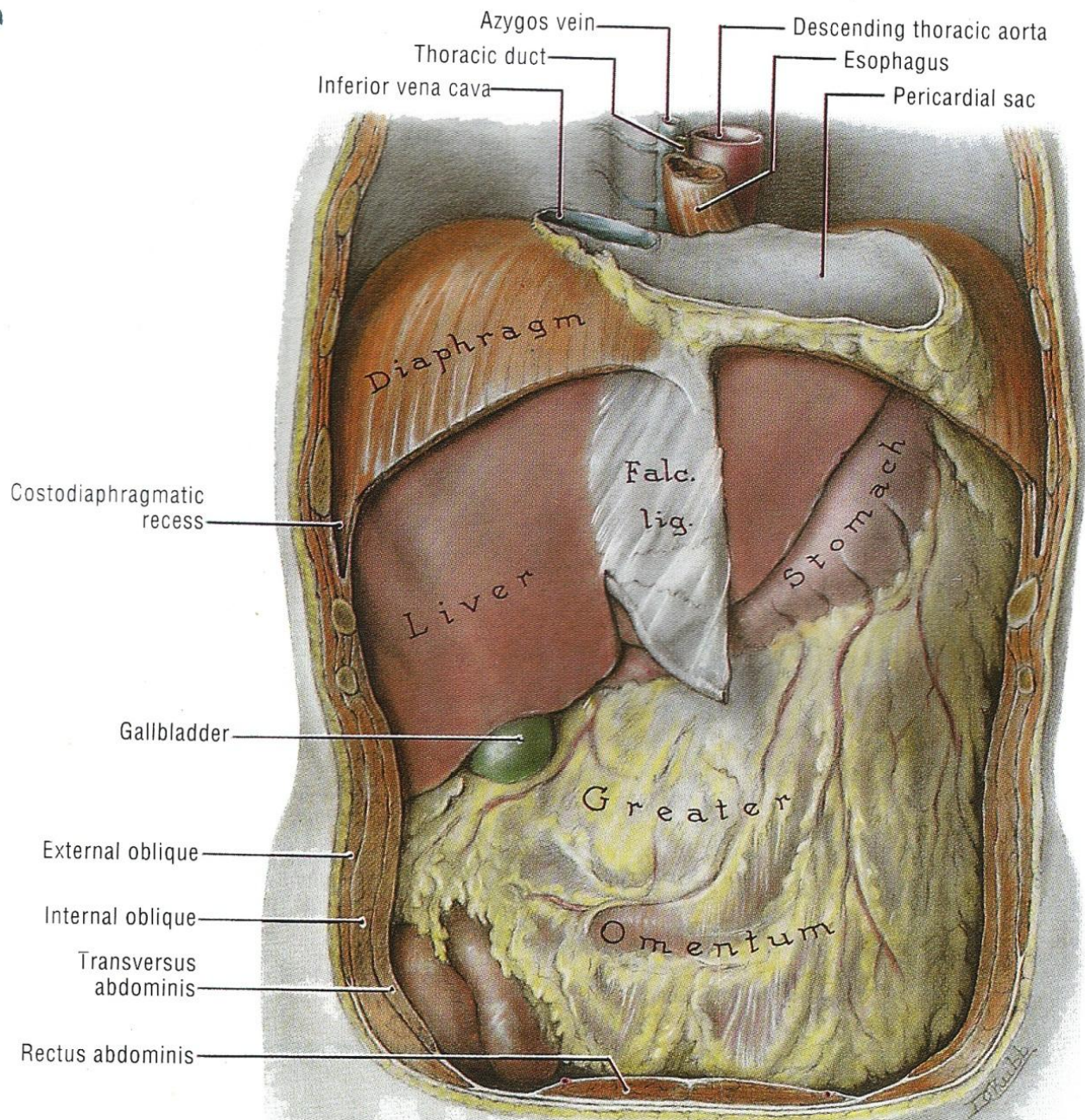
- Calibration or Measurement
- Depend on software available  
(e.g. Cardiac , OBGY and Renal ).

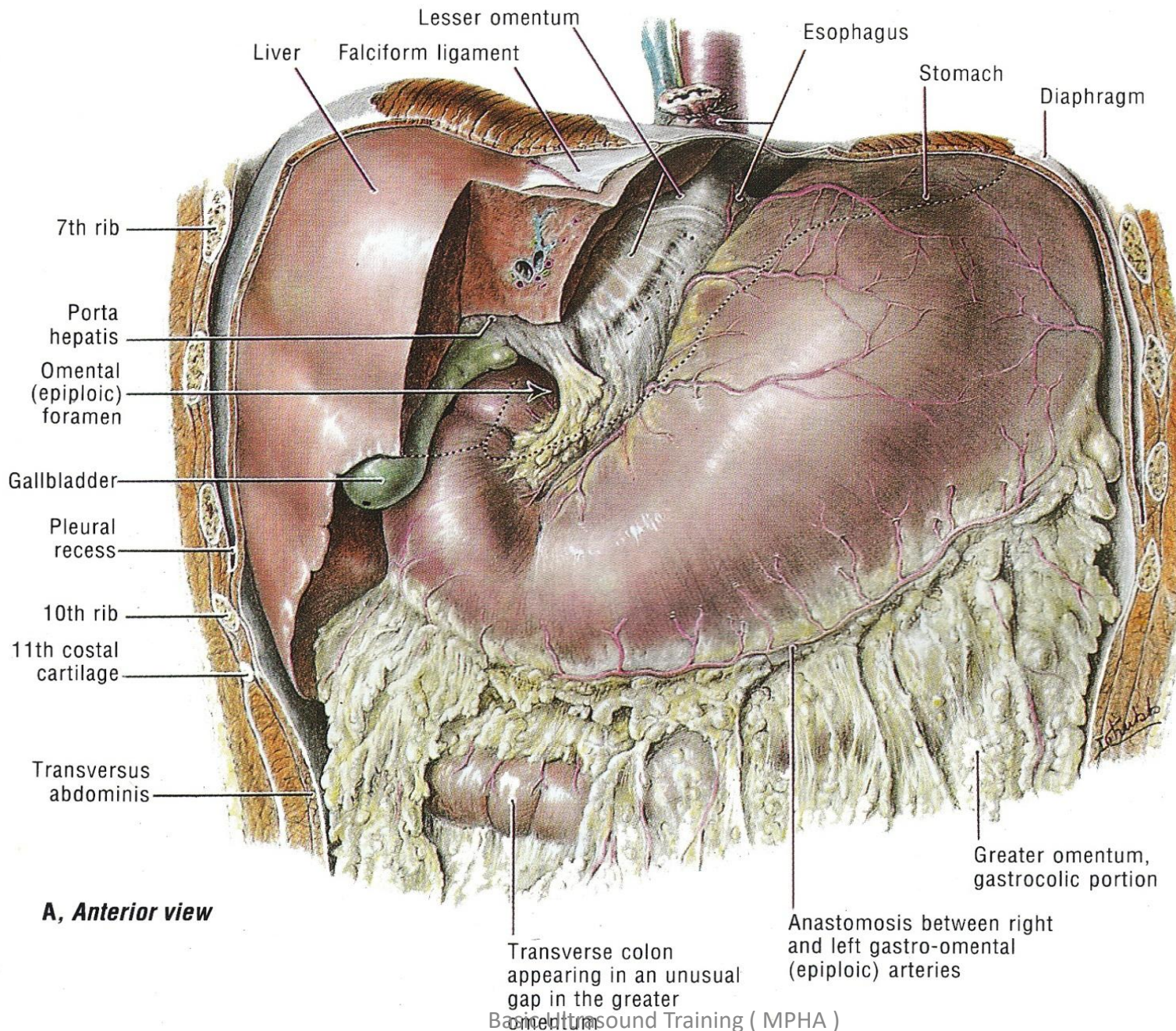
# Anatomy of Upper Abdomen

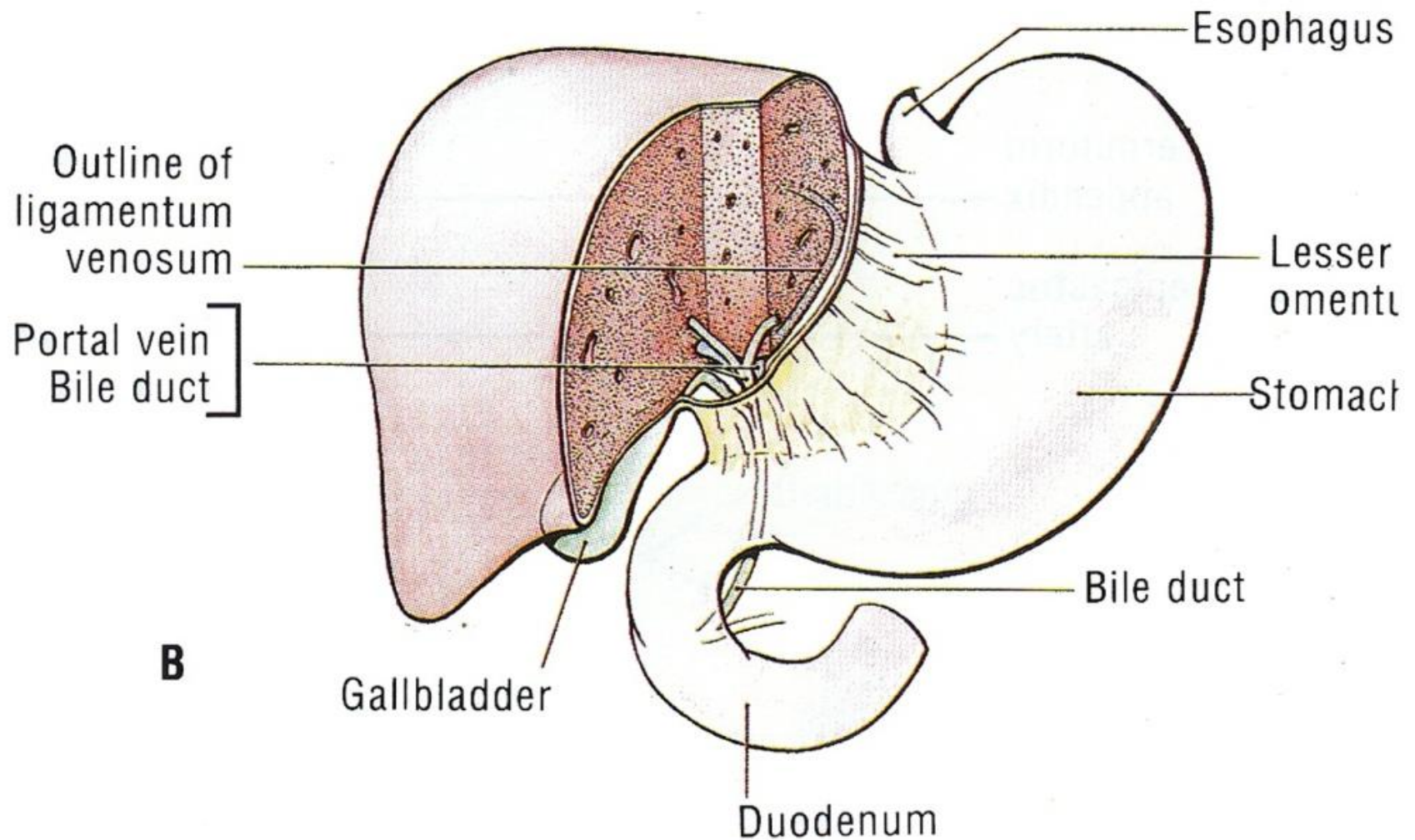


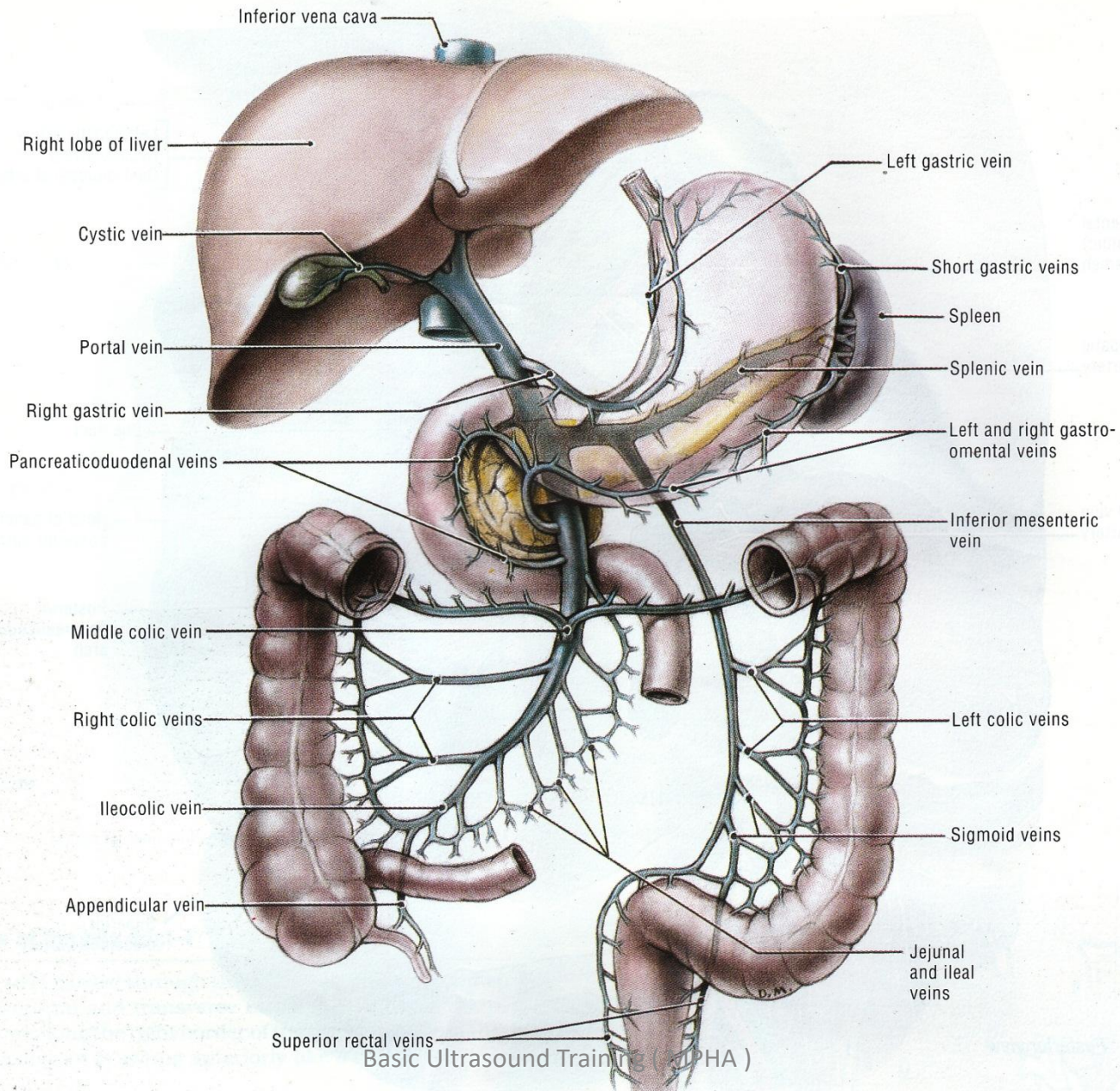


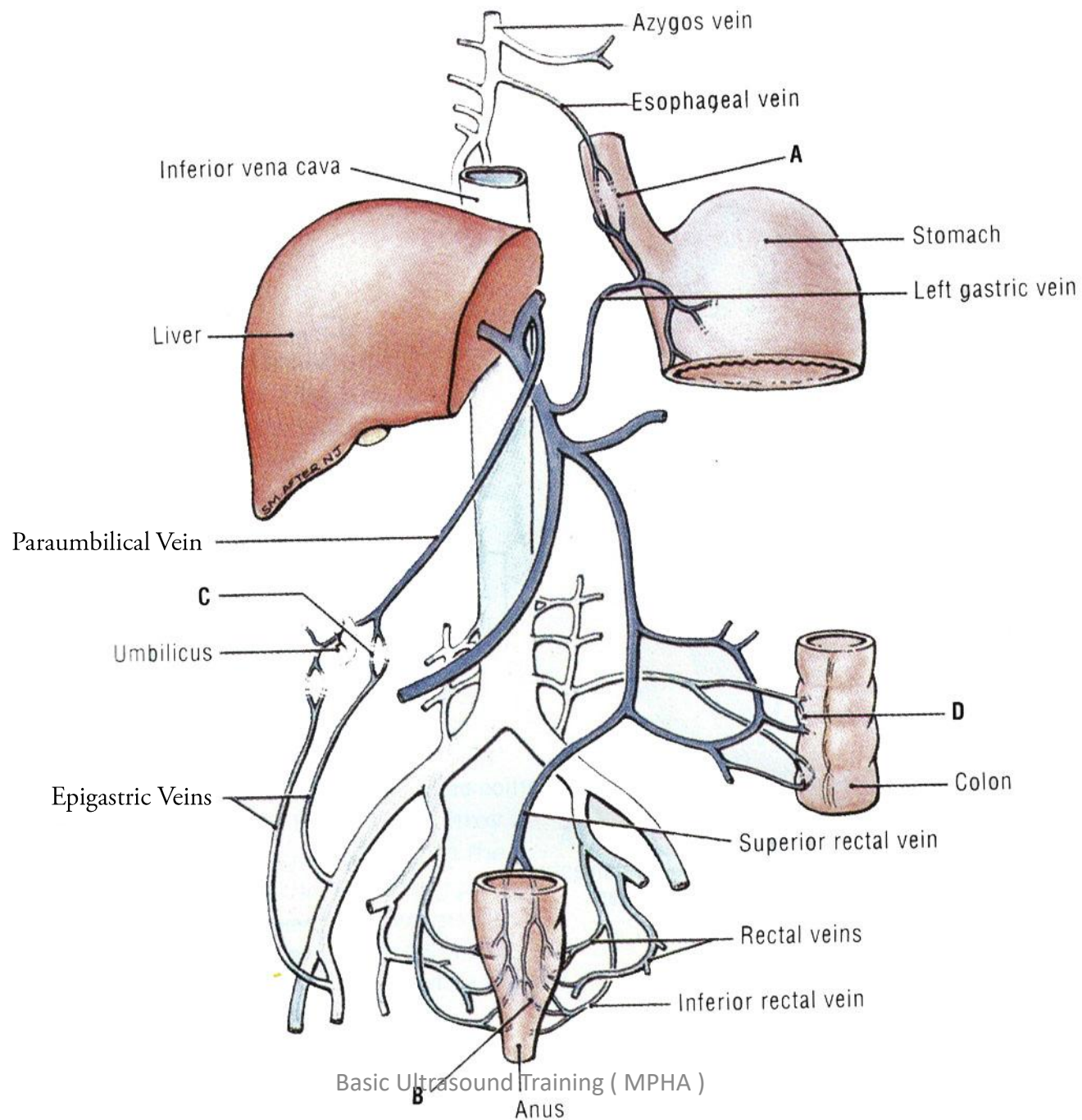
**B, Posterior view**

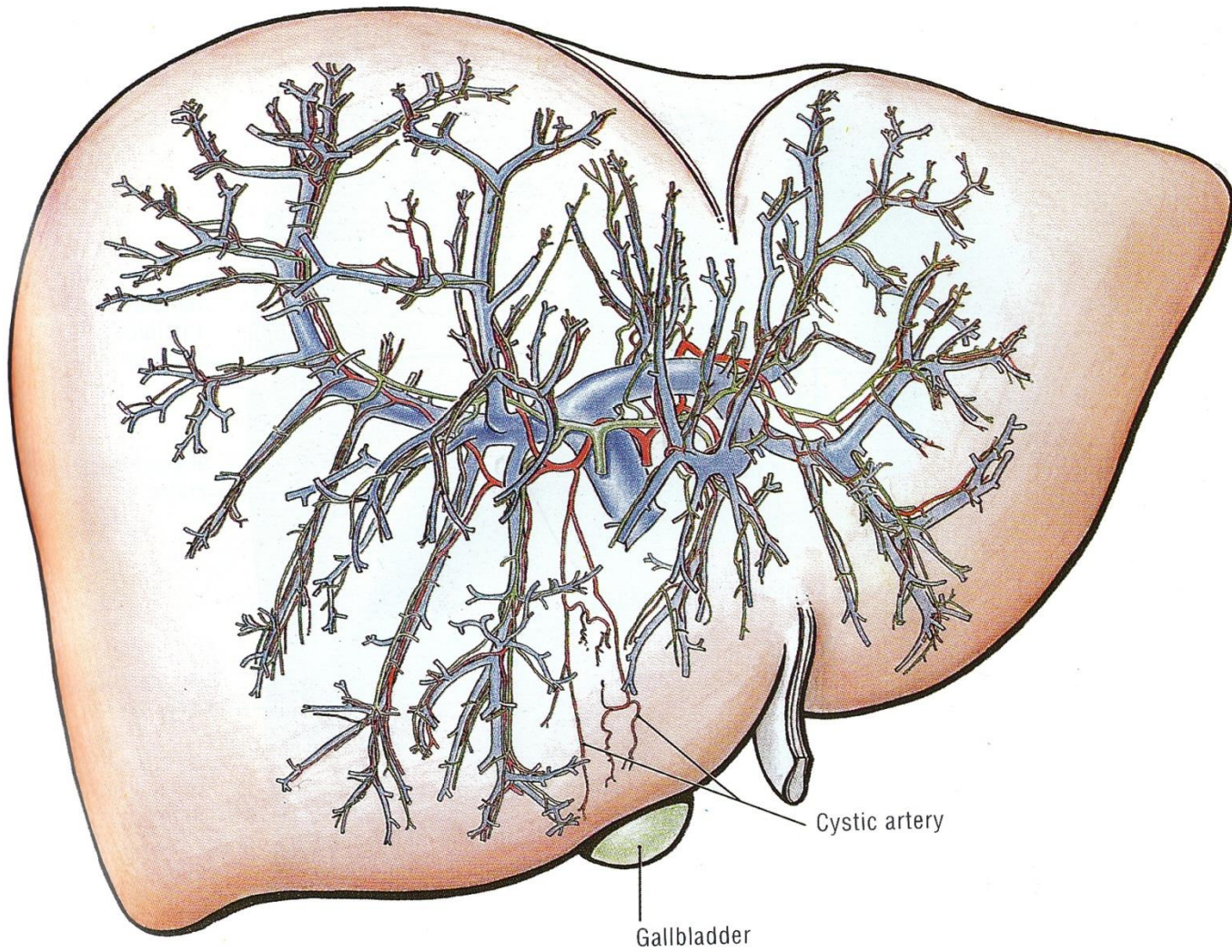


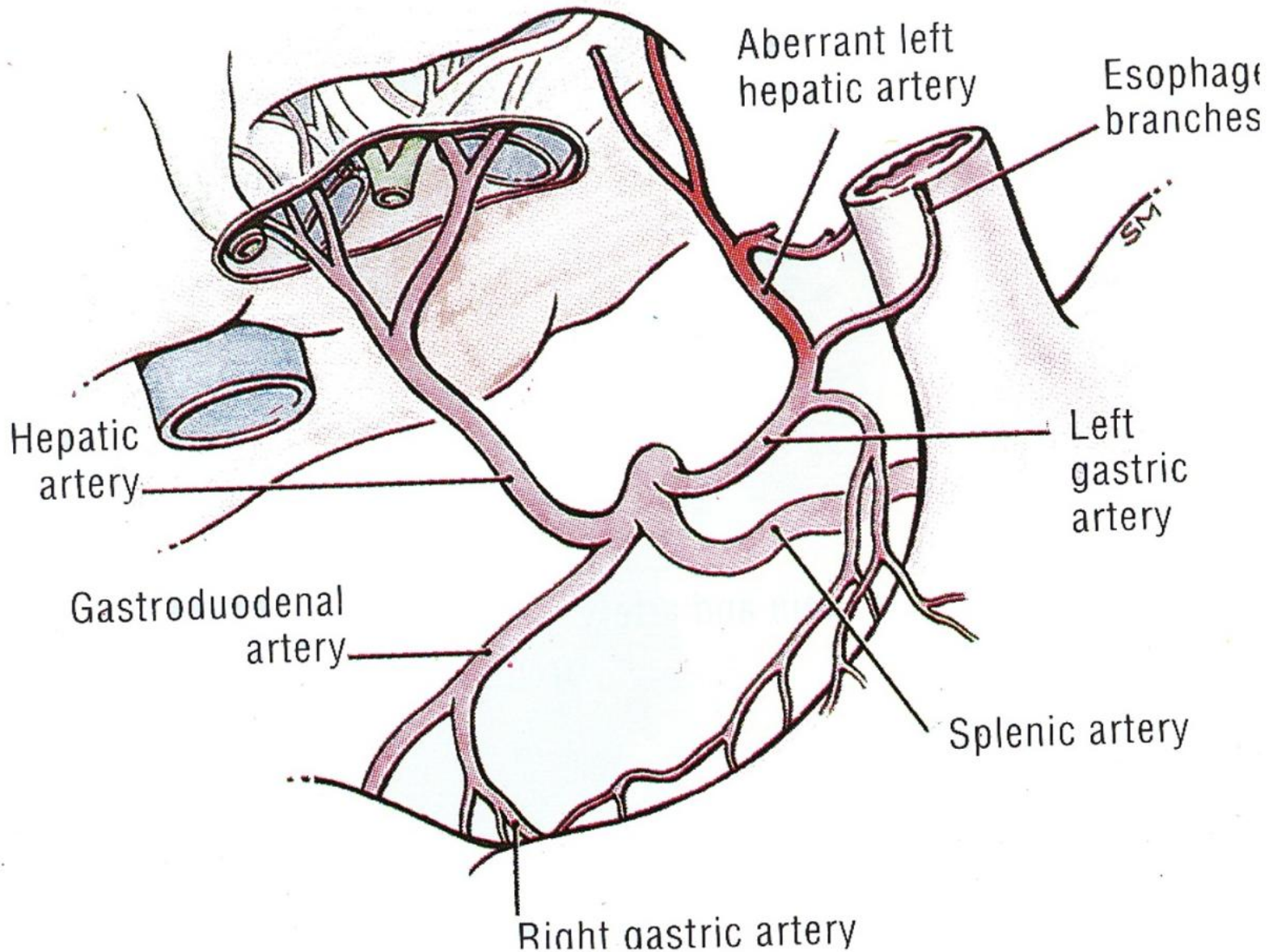


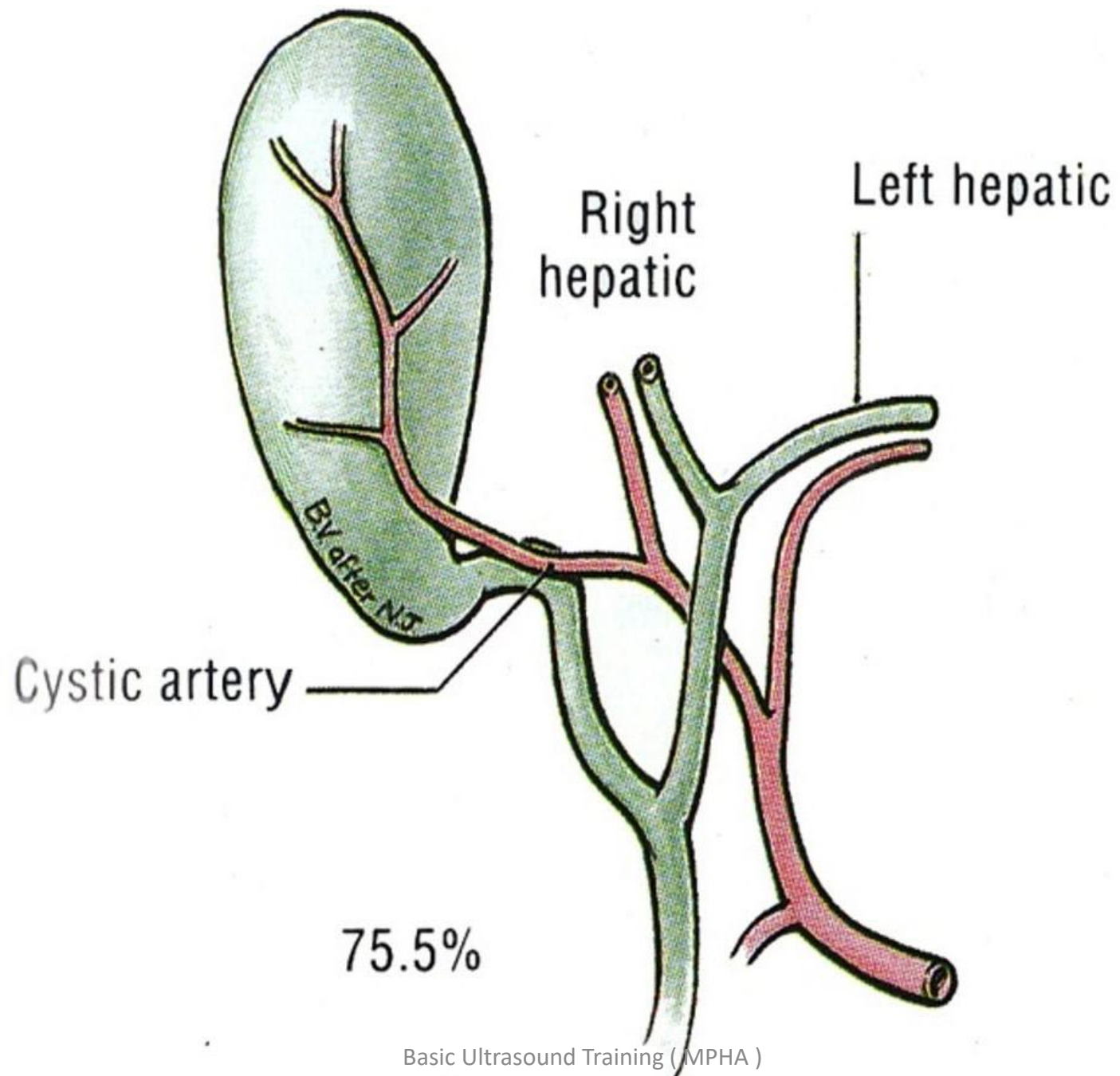


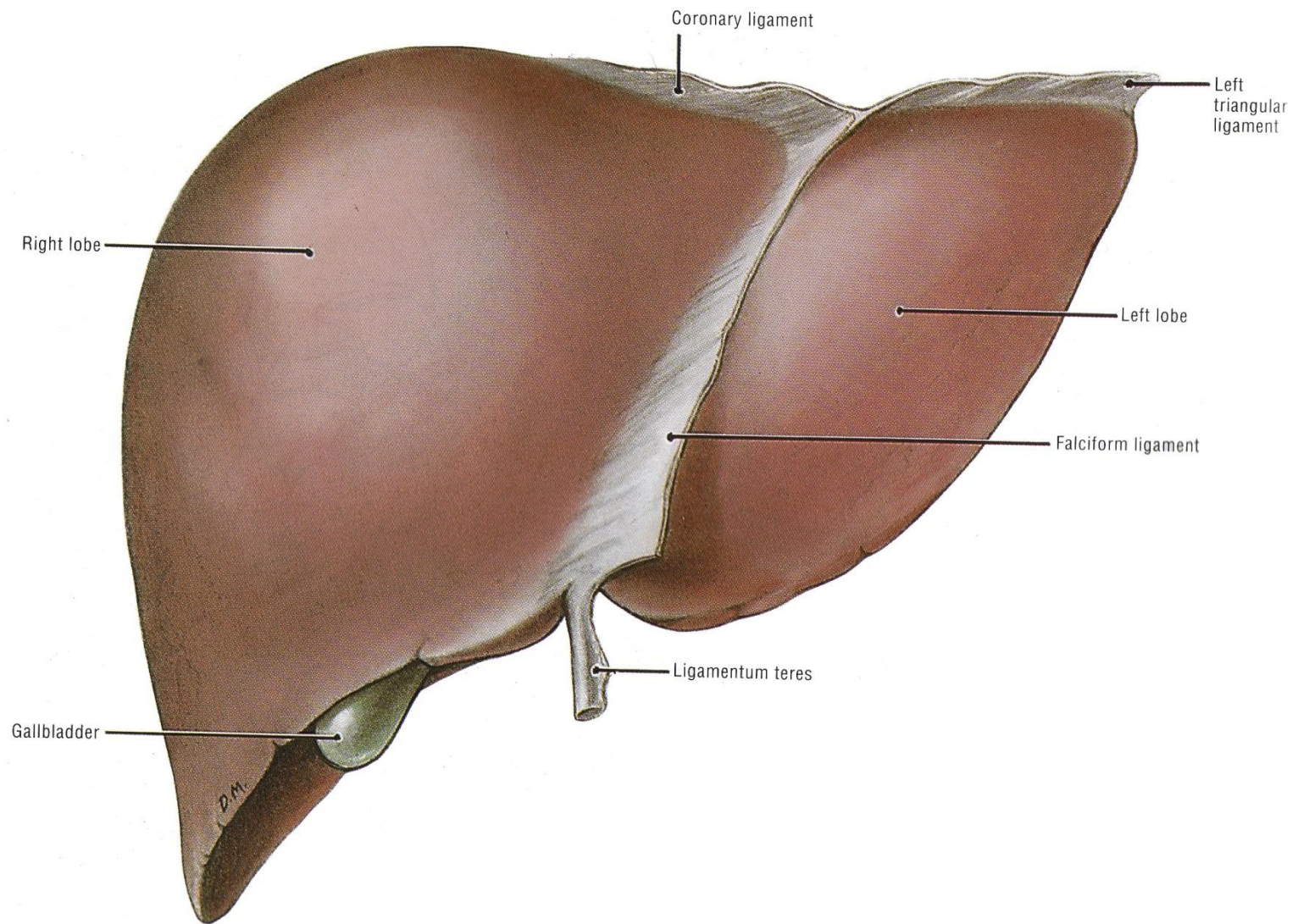


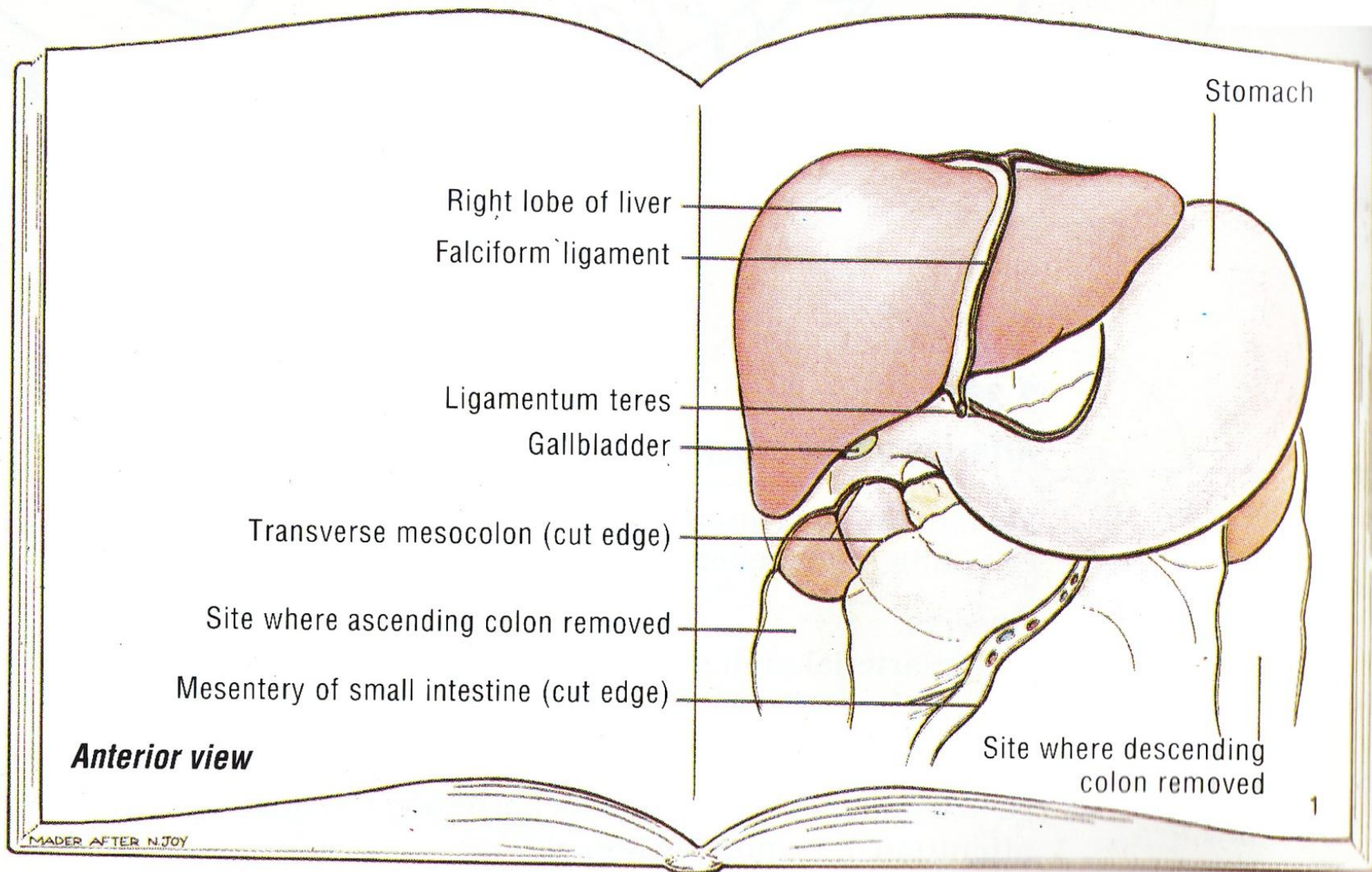


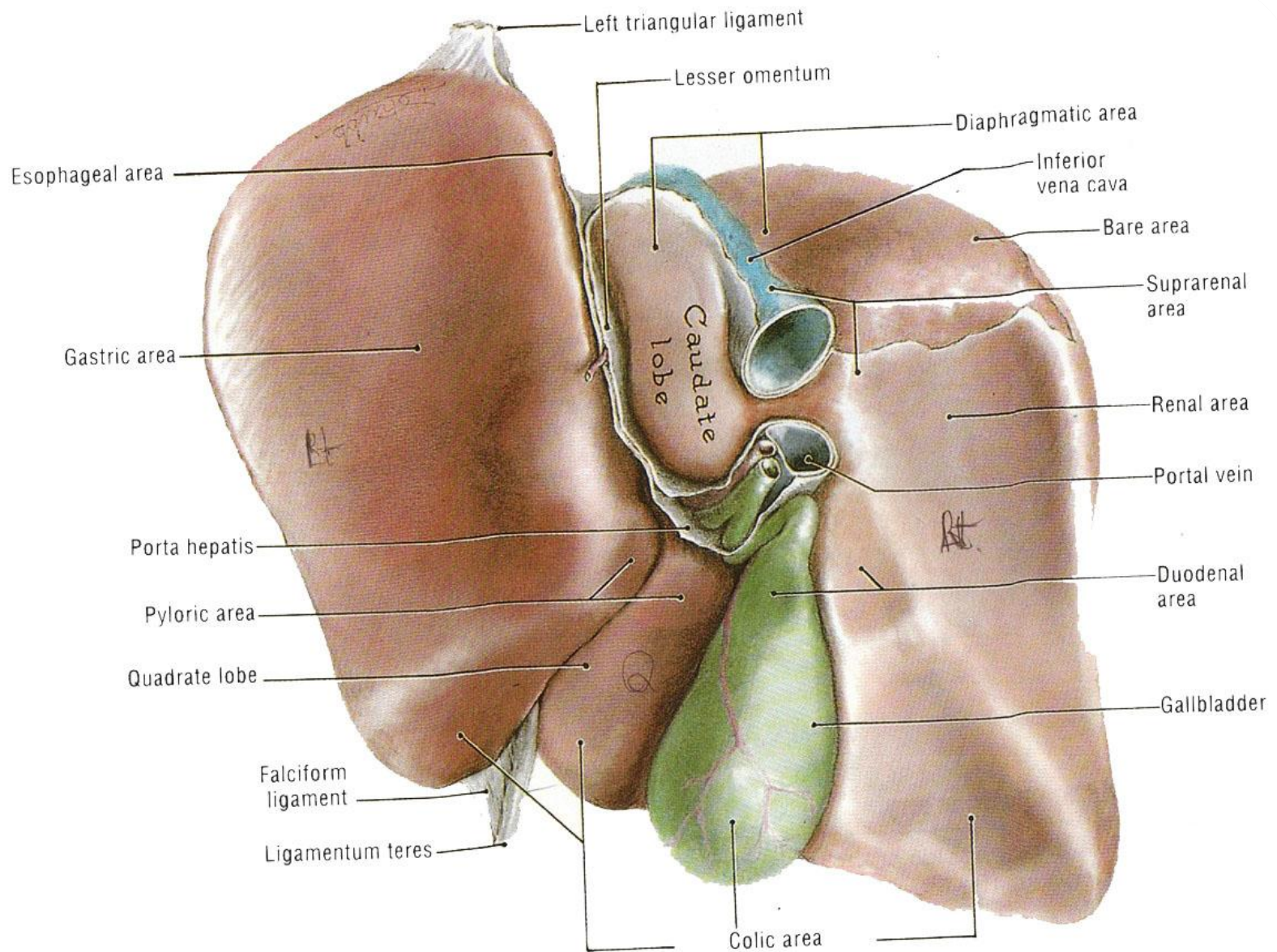


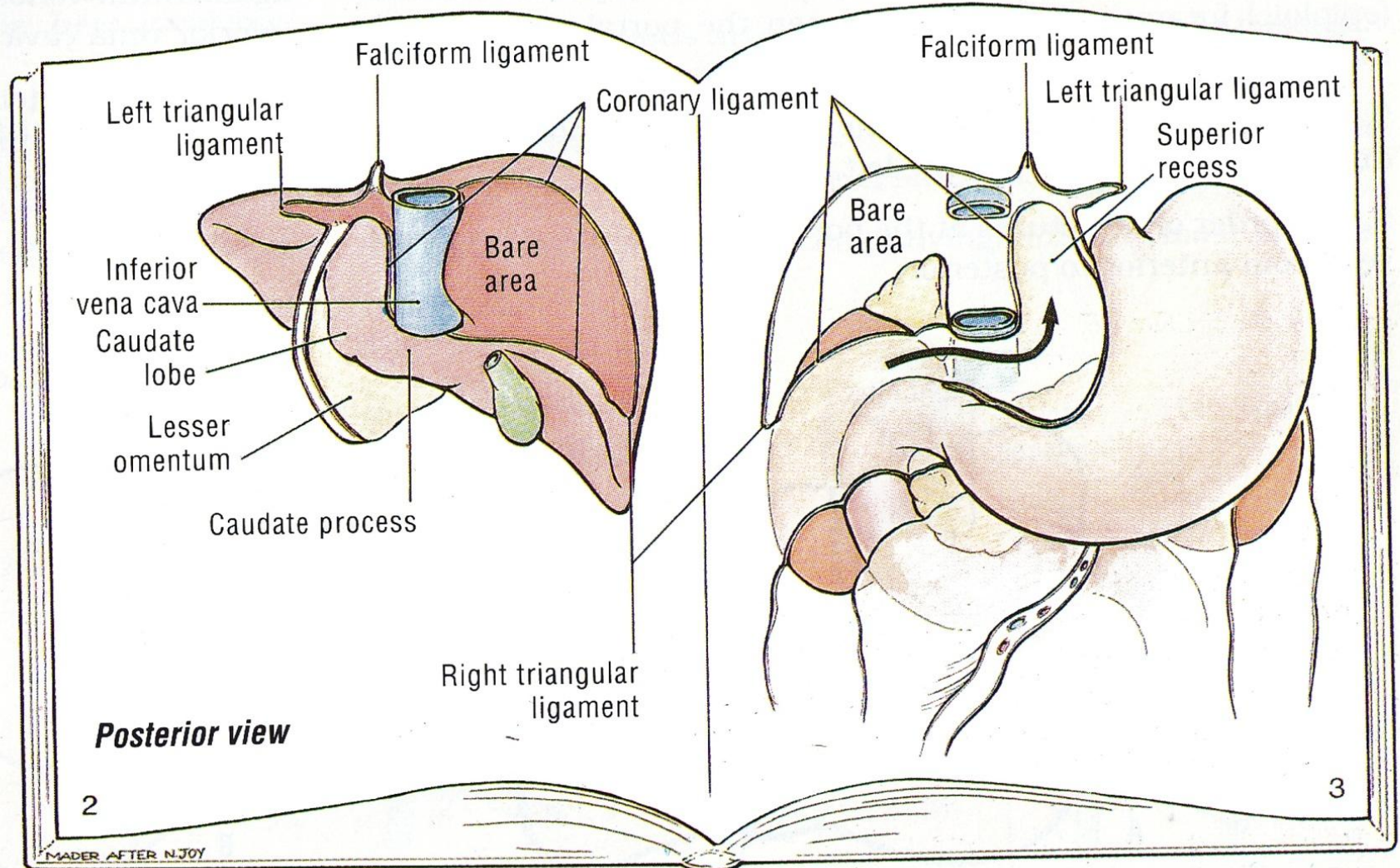


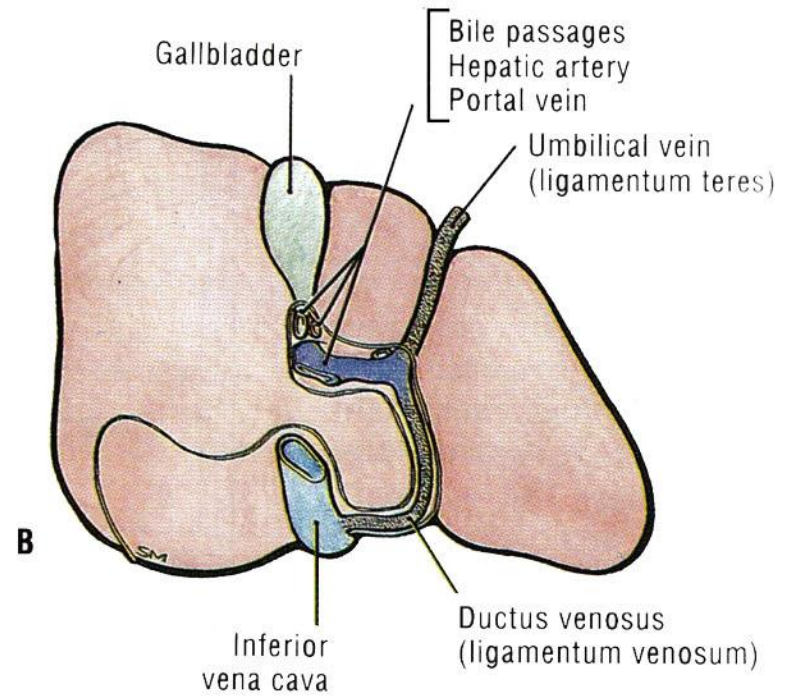
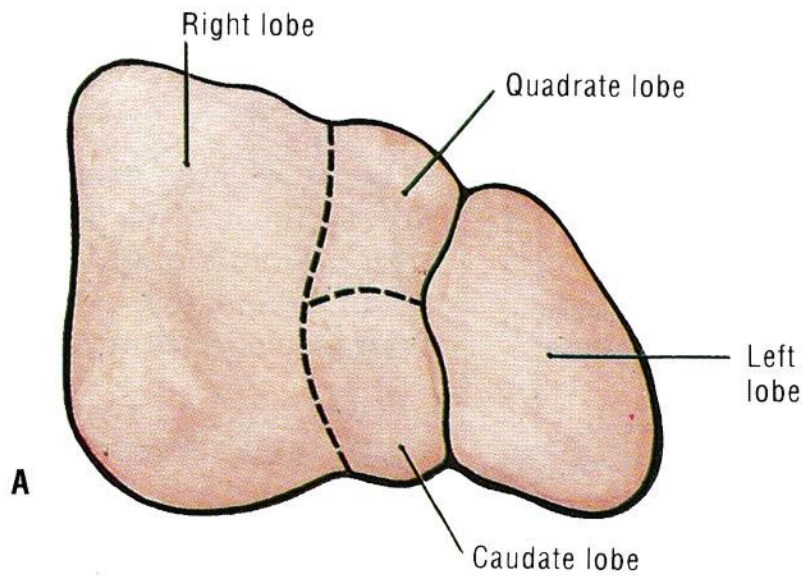


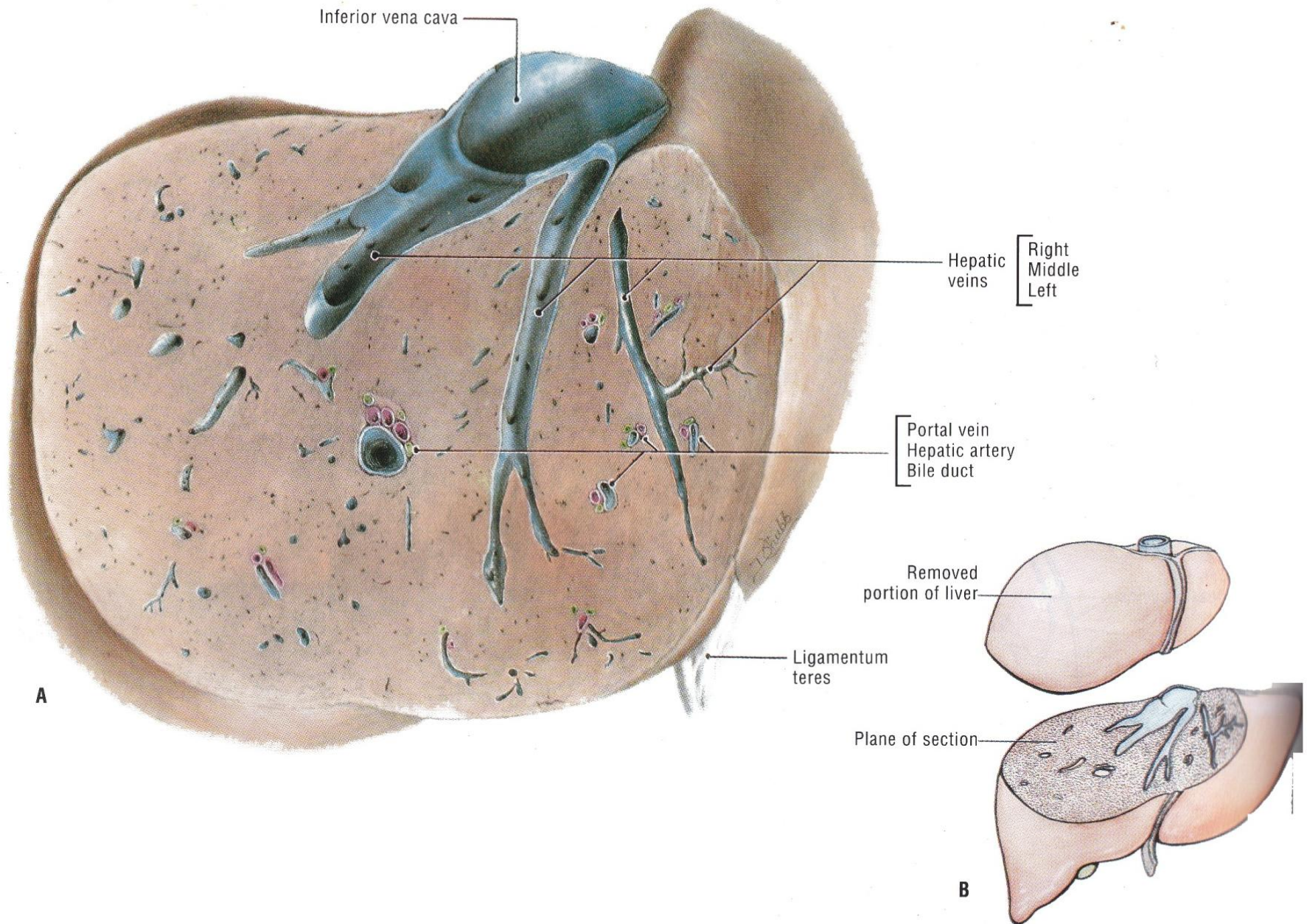


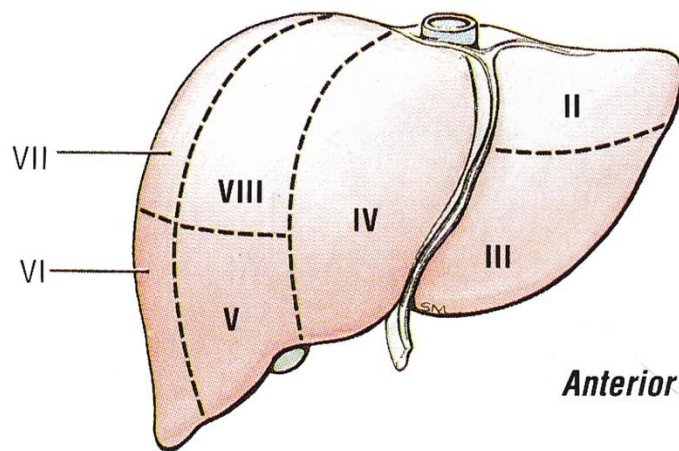




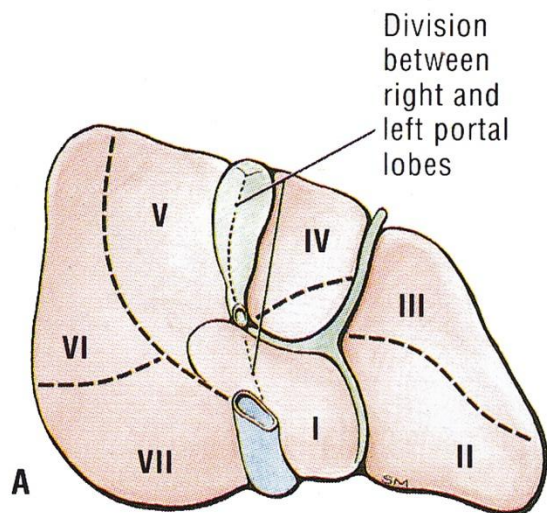
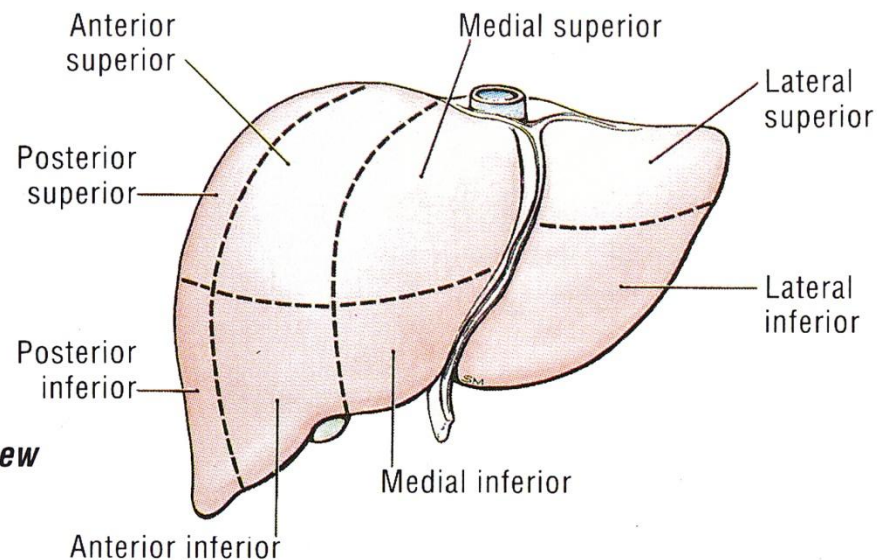




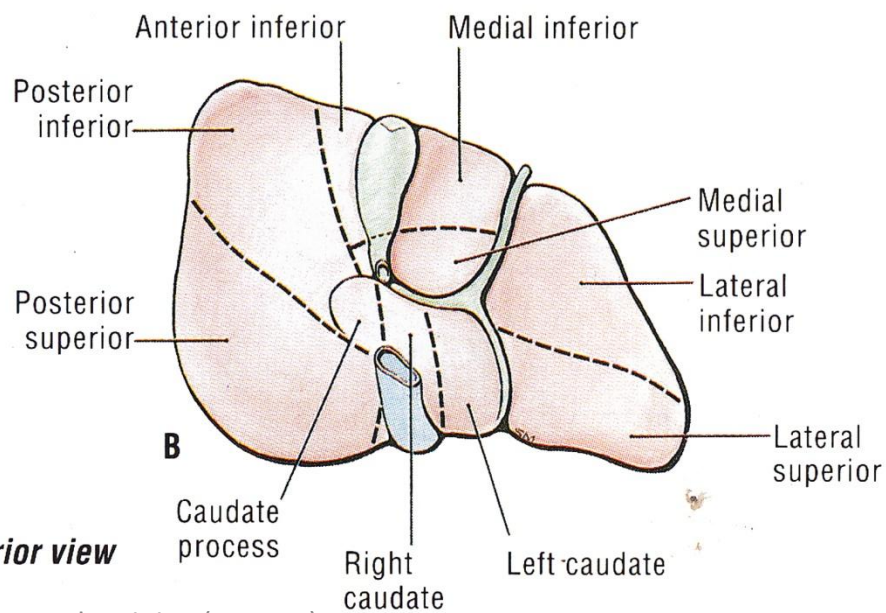


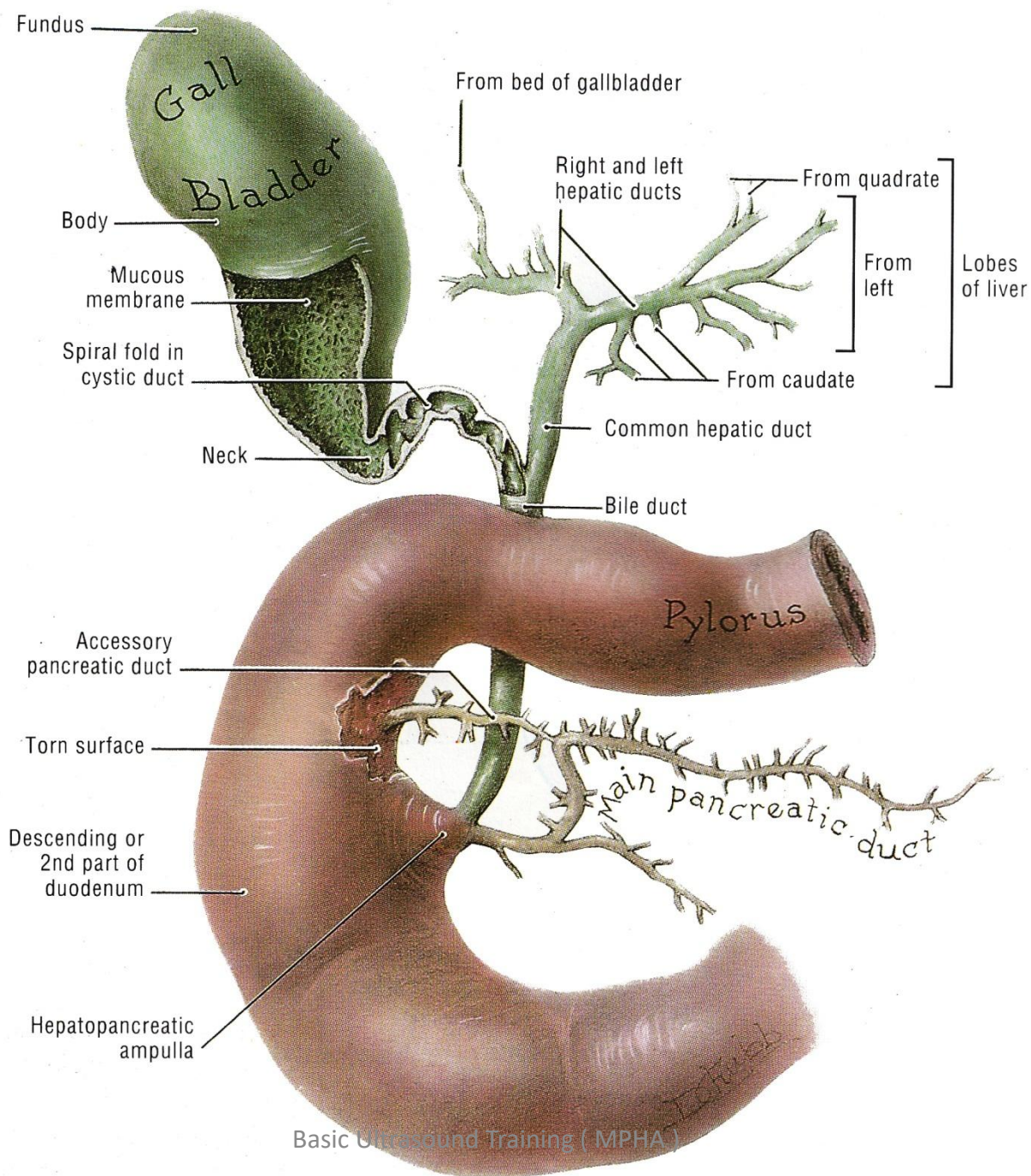


**Anterior view**

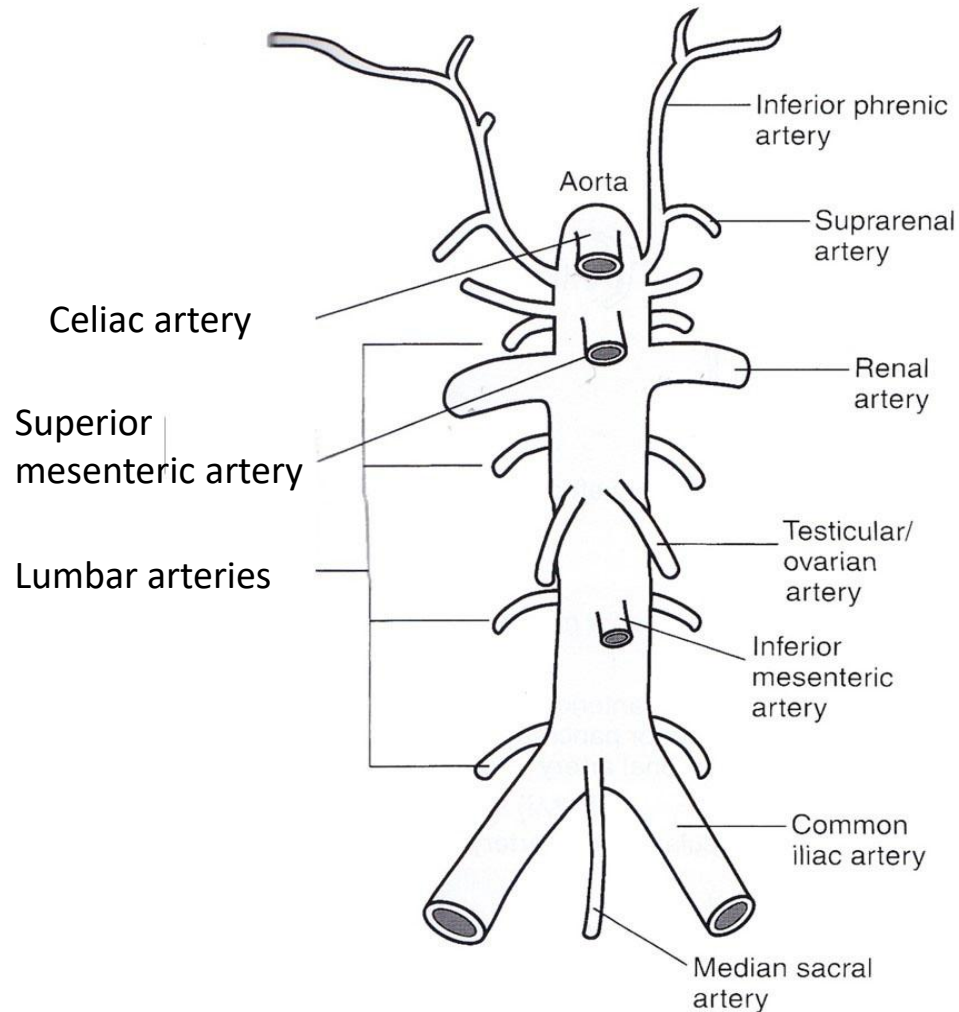


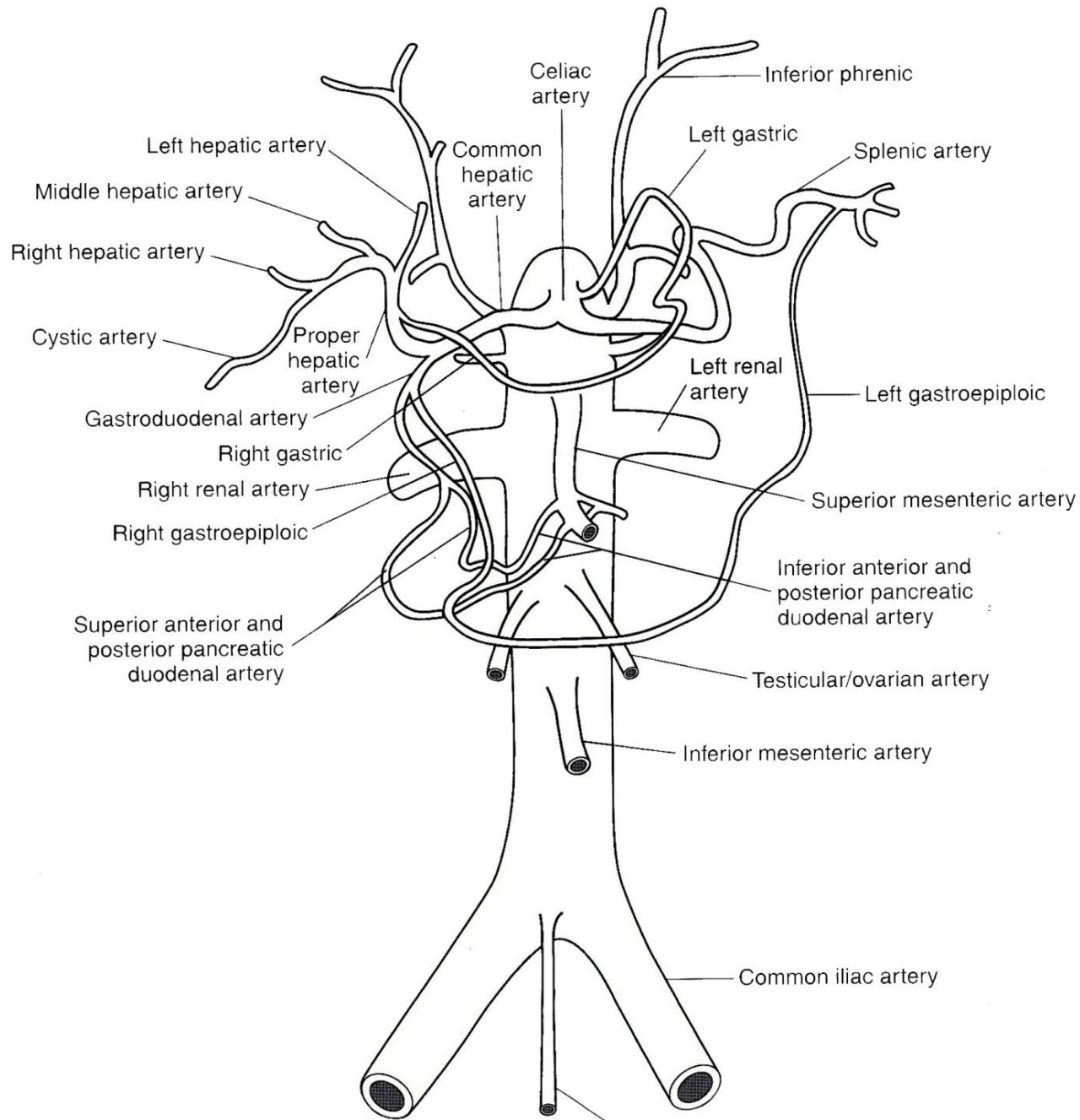
**Posteroinferior view**

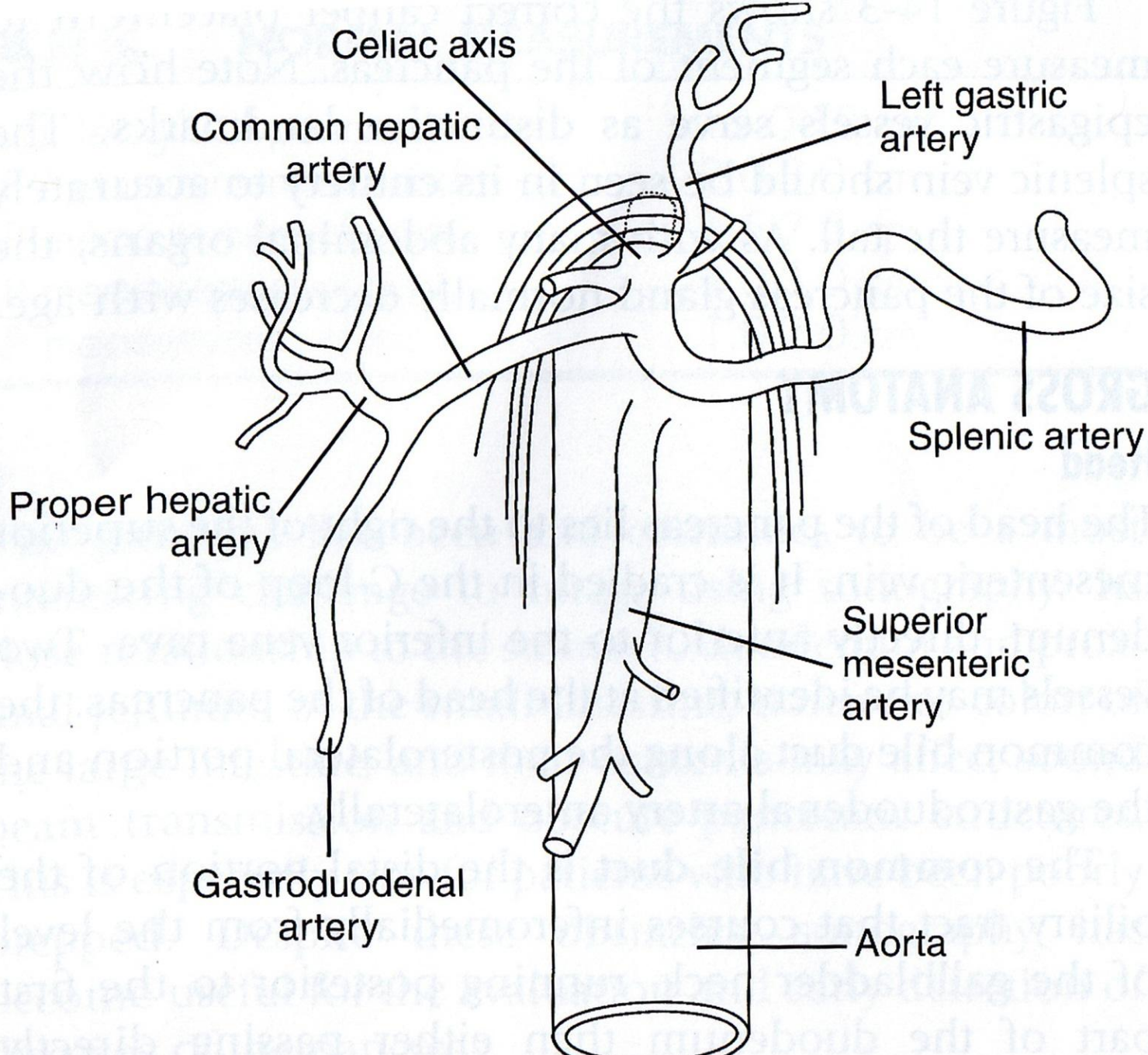




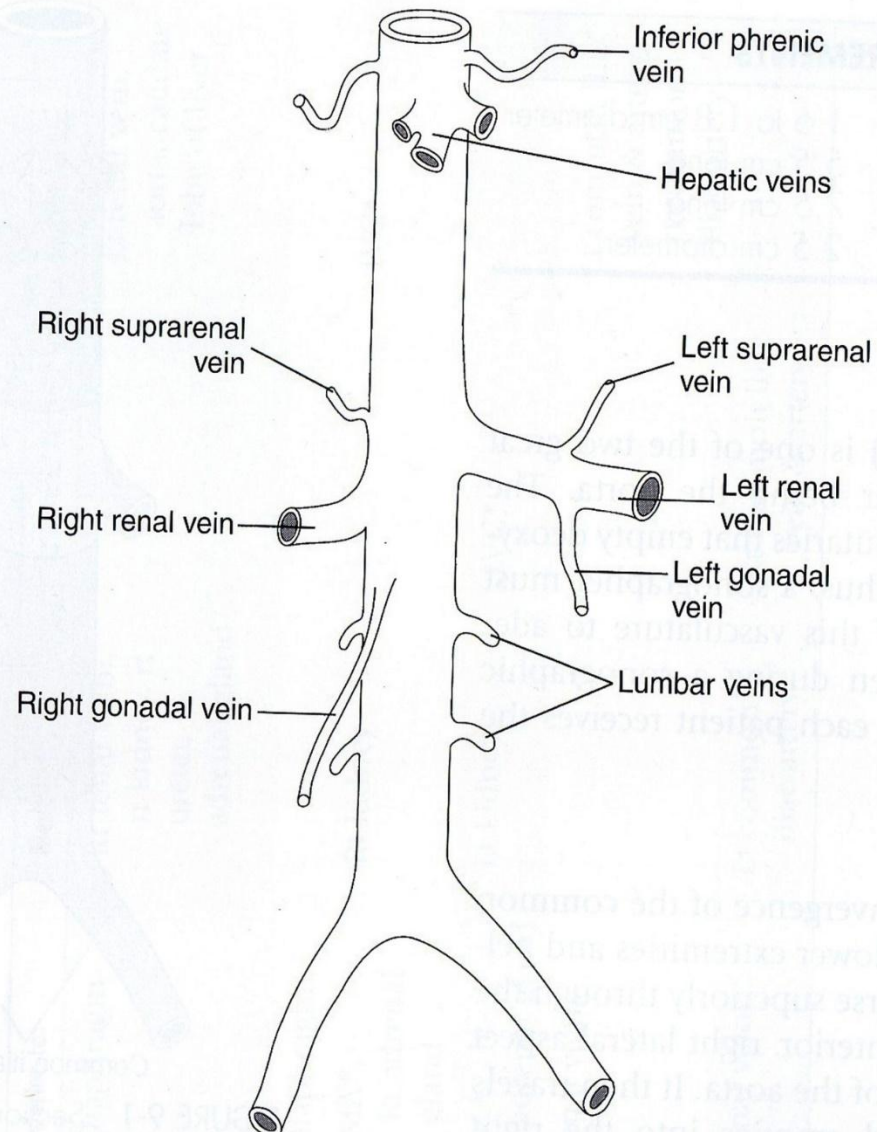
# Arteries of Abdomen

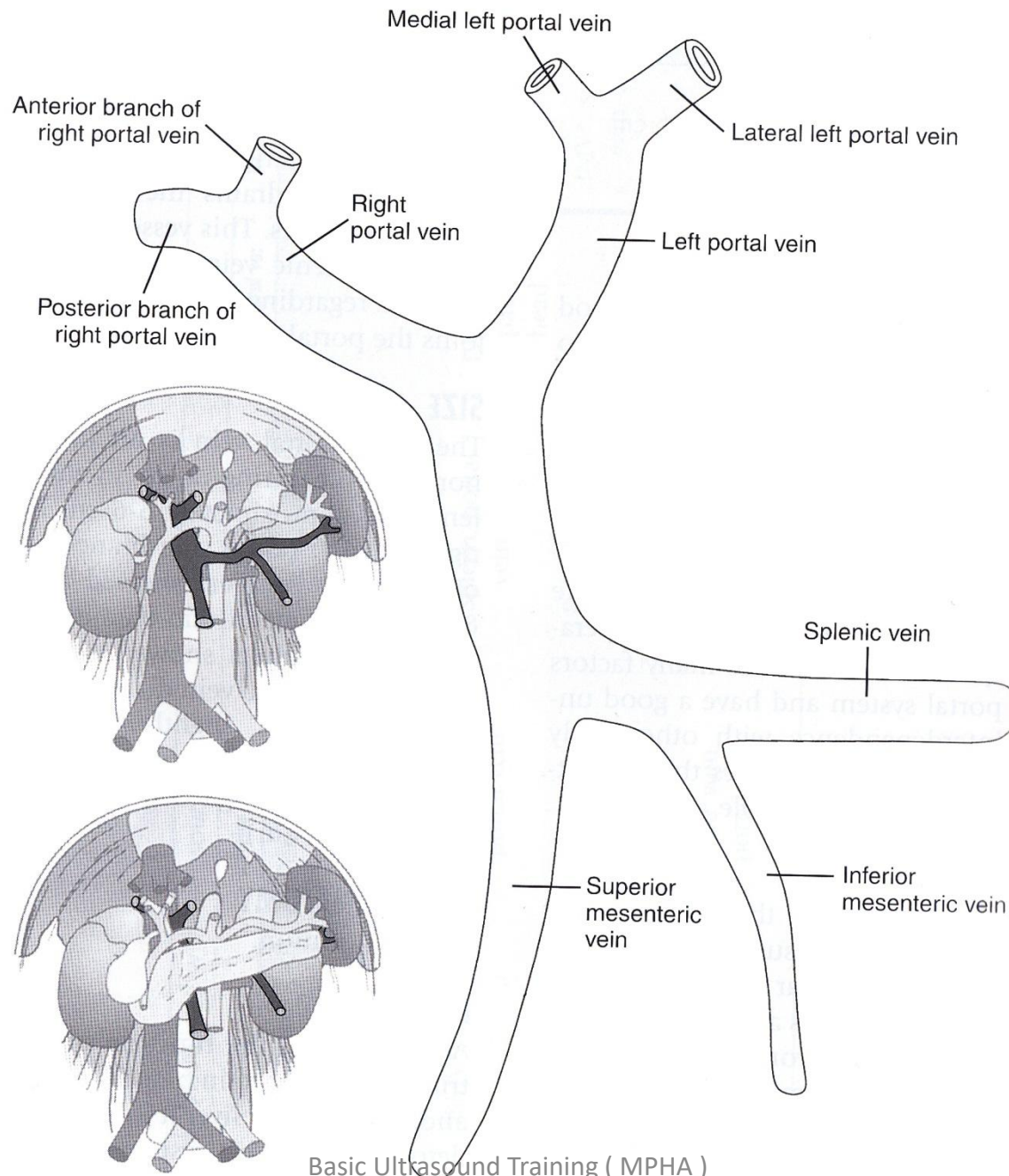






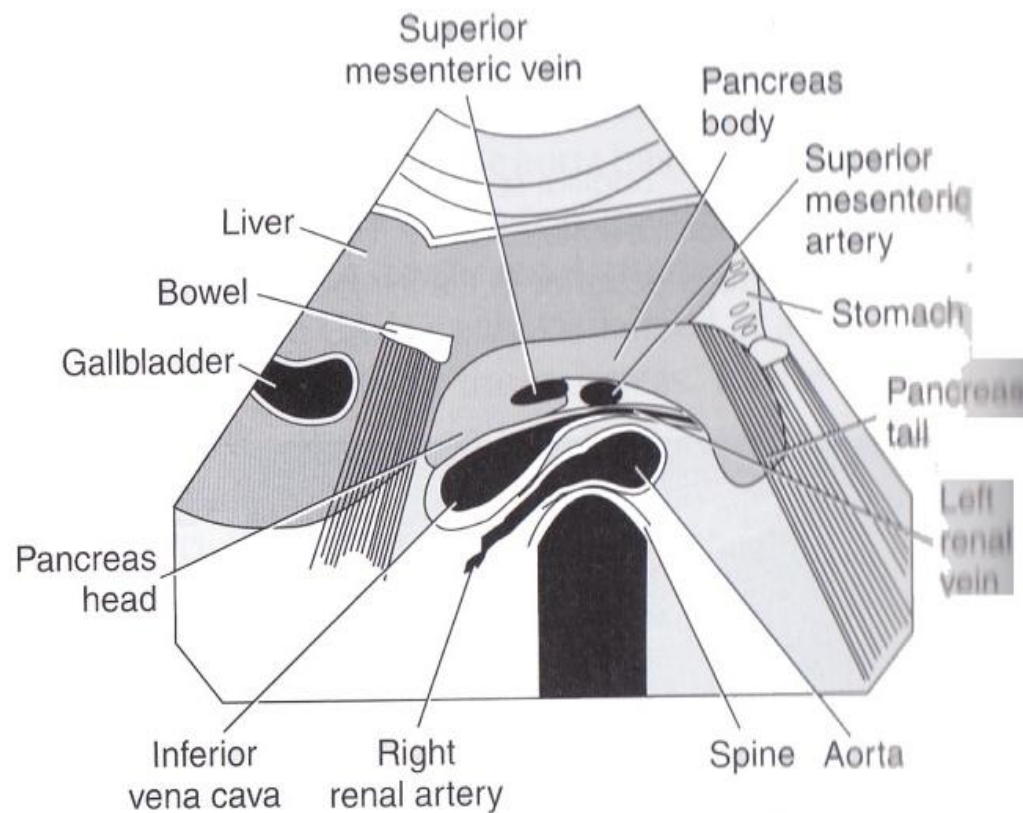
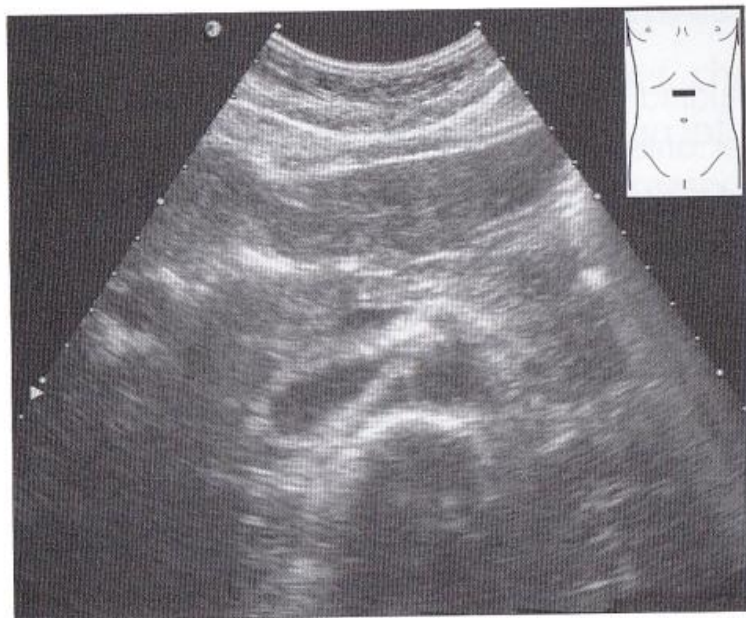
# Veins of Abdomen

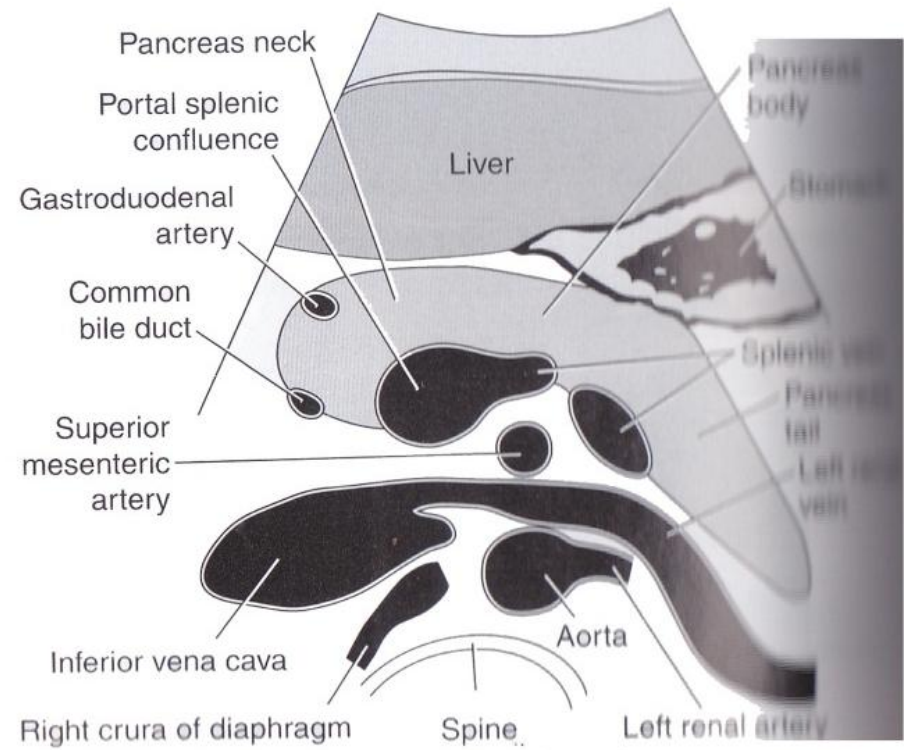
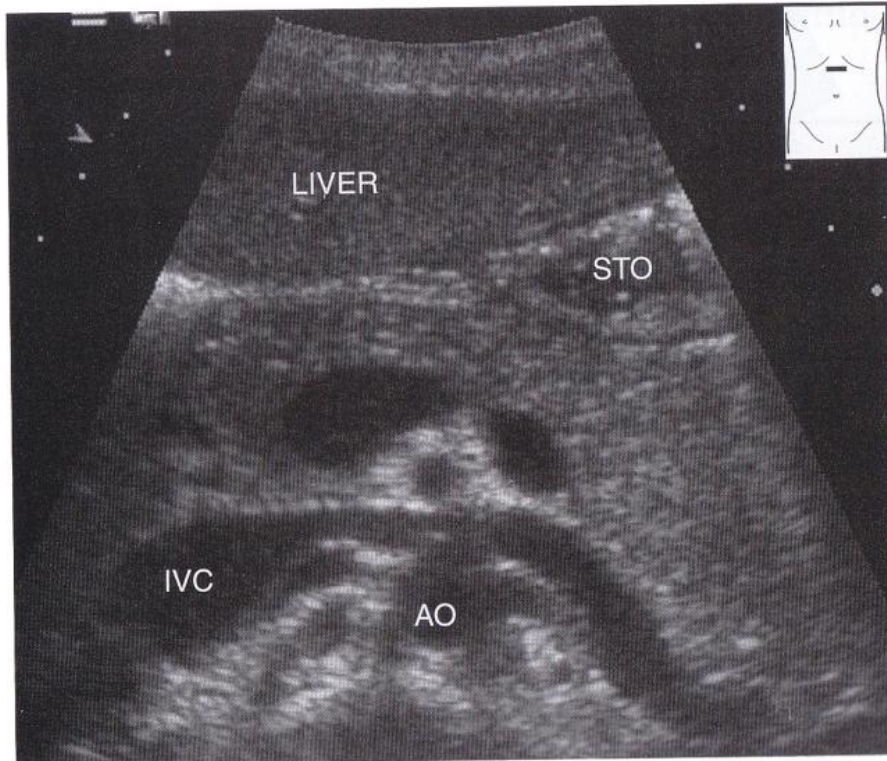


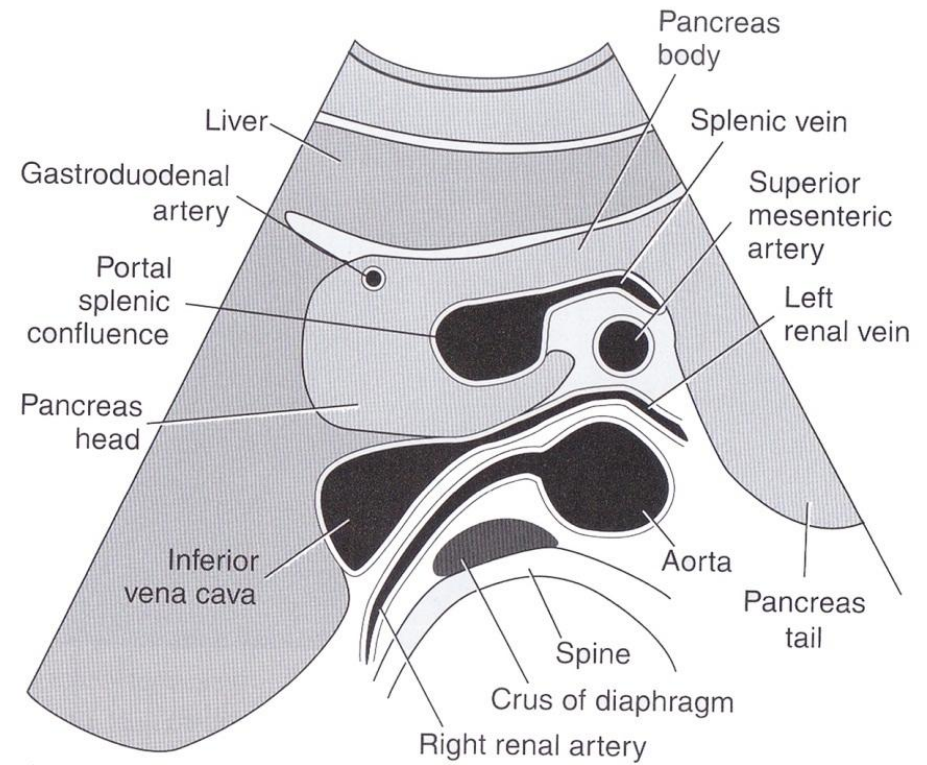


# Abdominal – Window

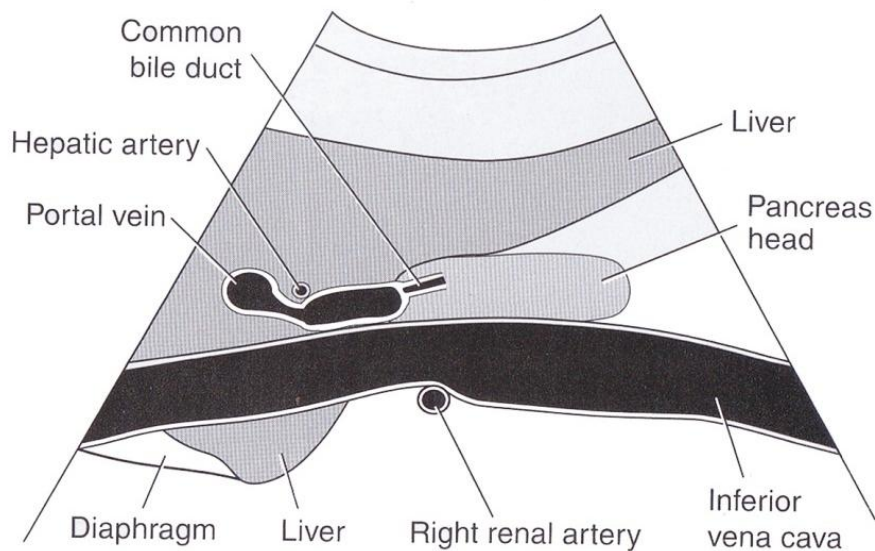
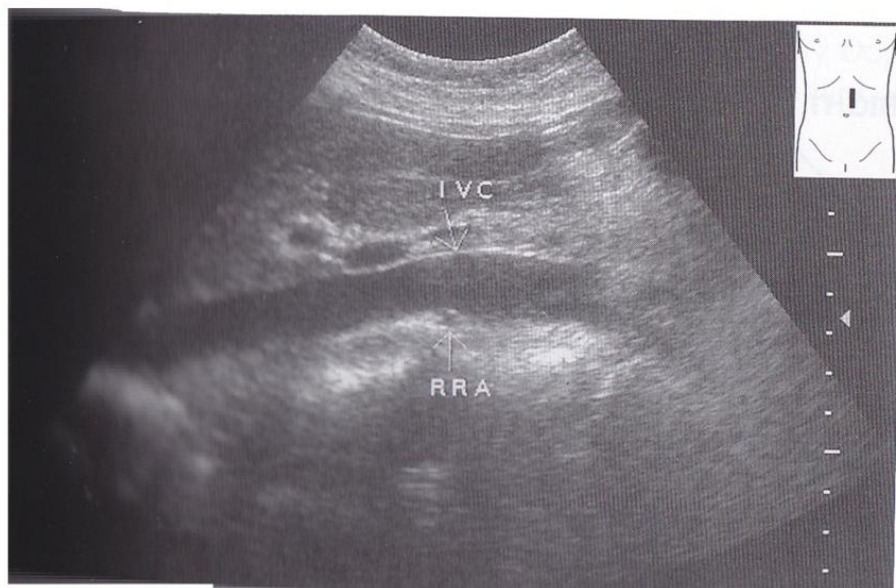
# Epi gastric Horizontal Window

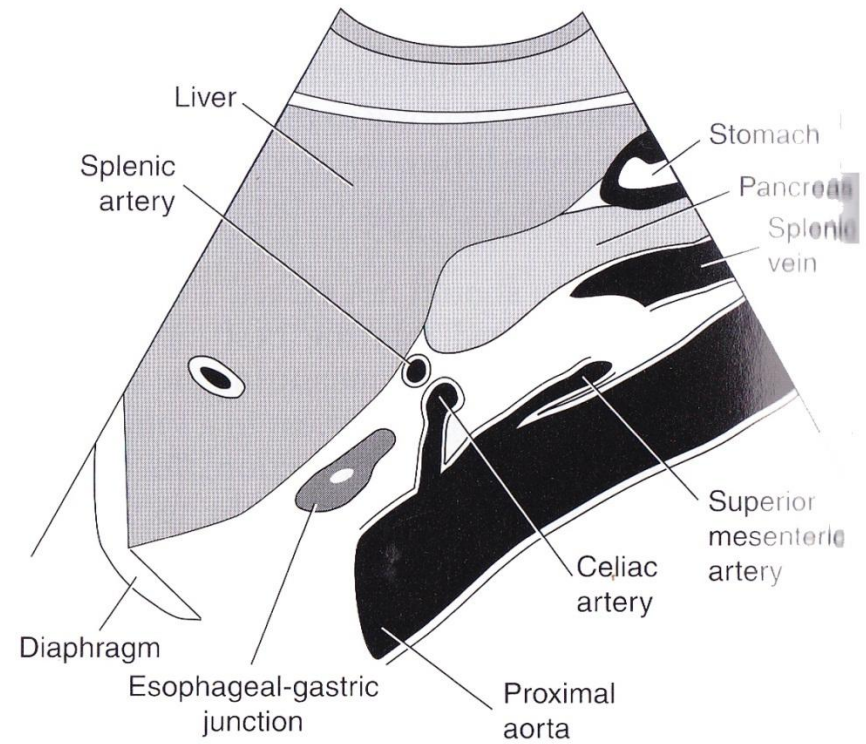
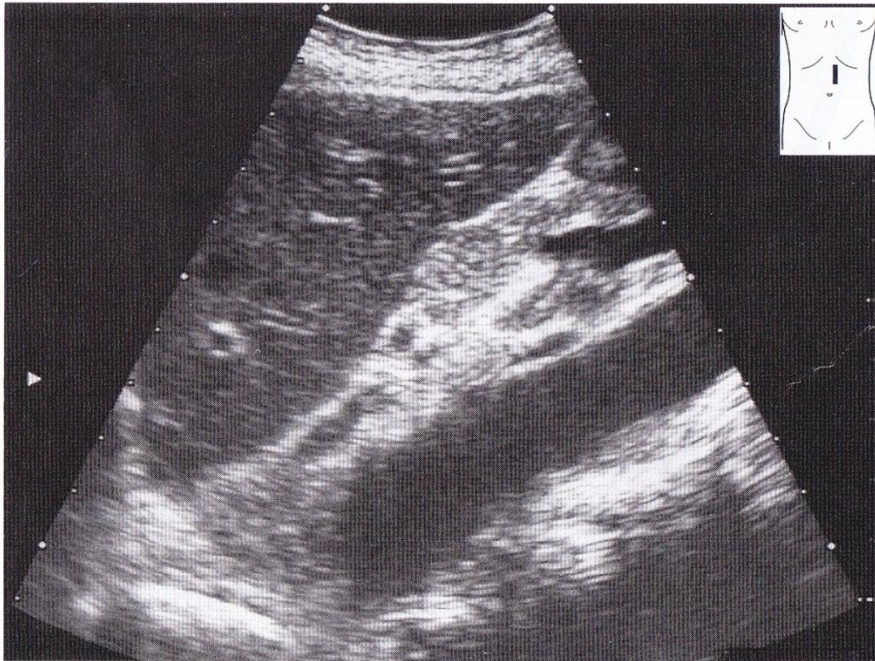


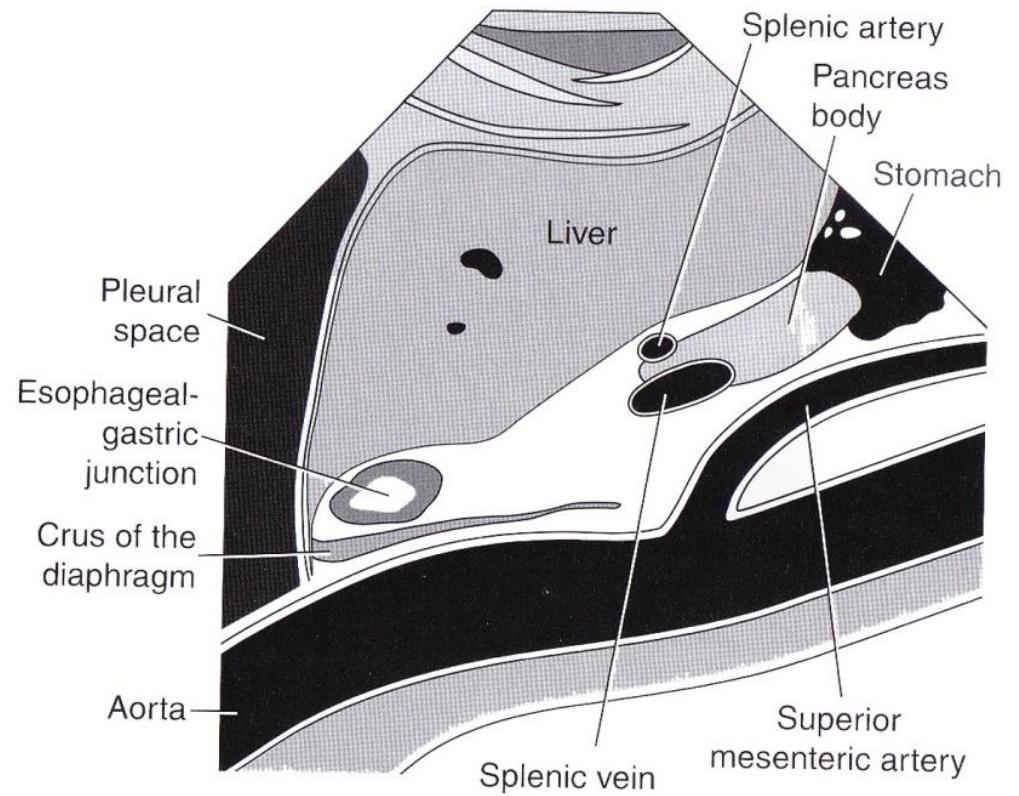
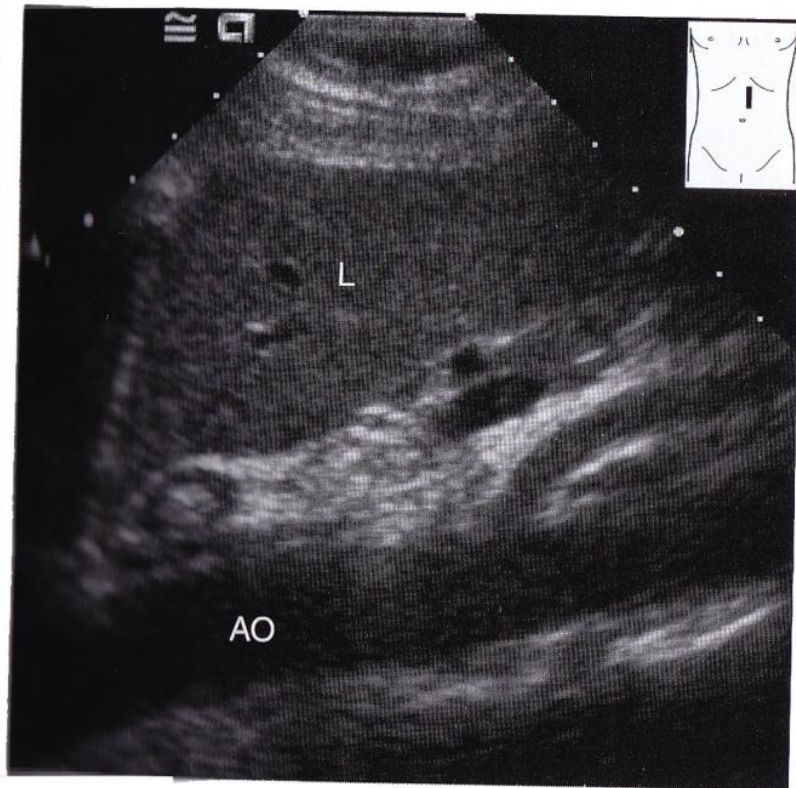


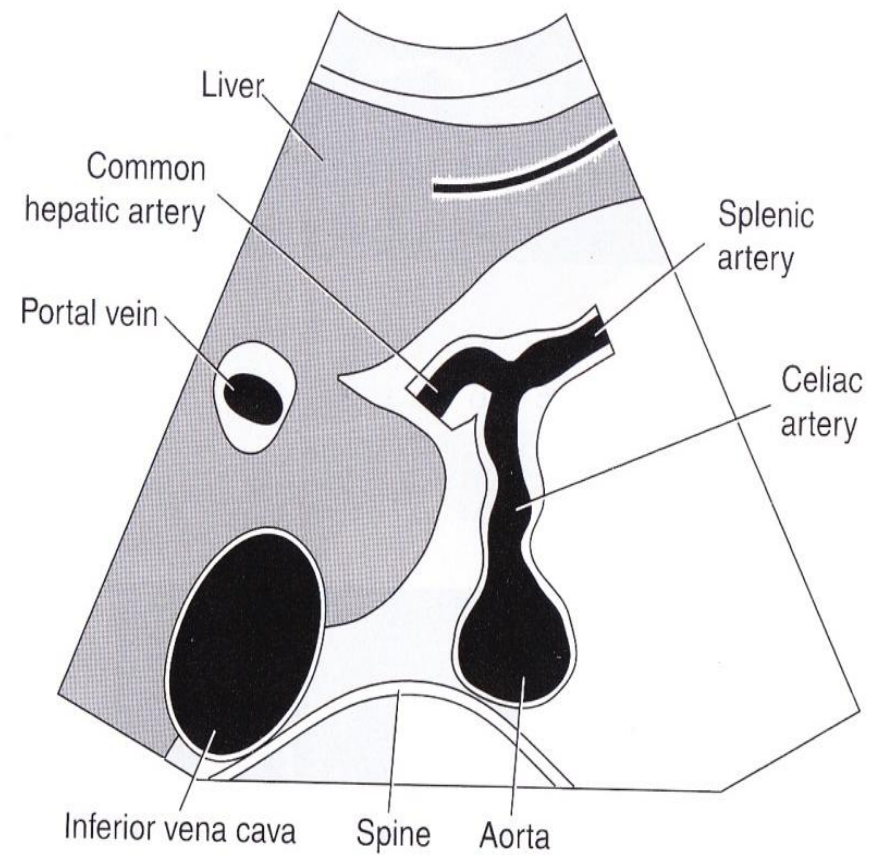
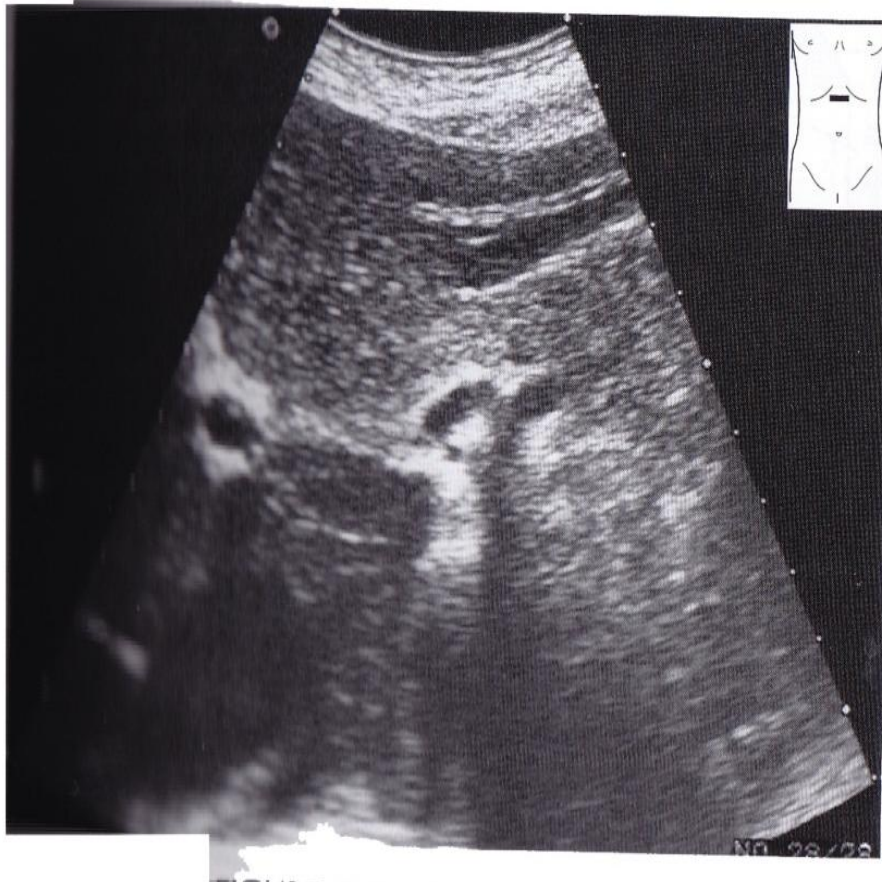


# Epi gastric Sagittal Window

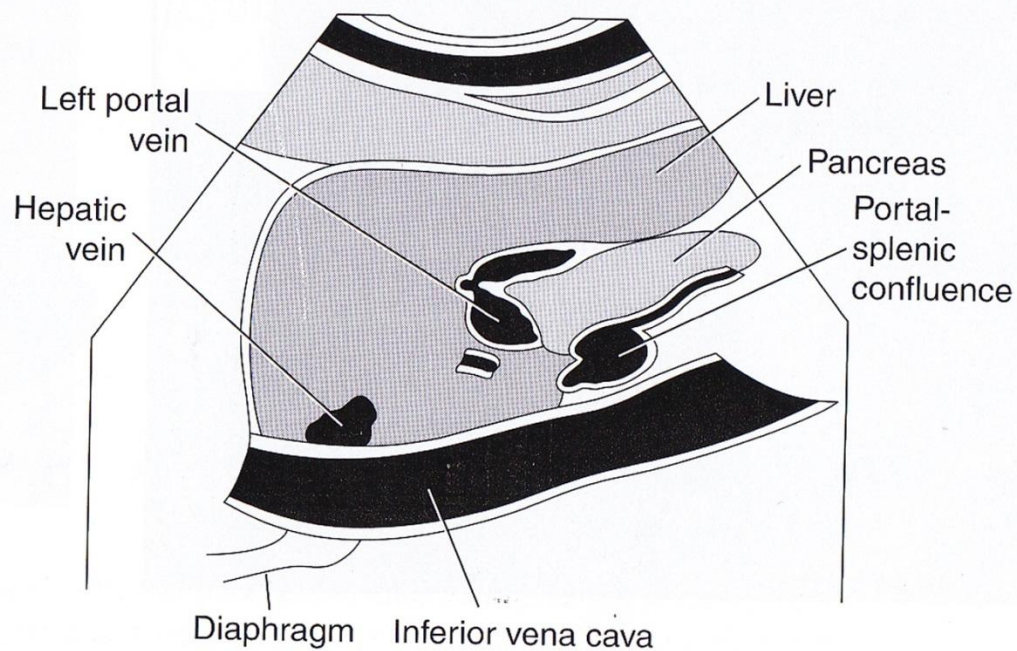
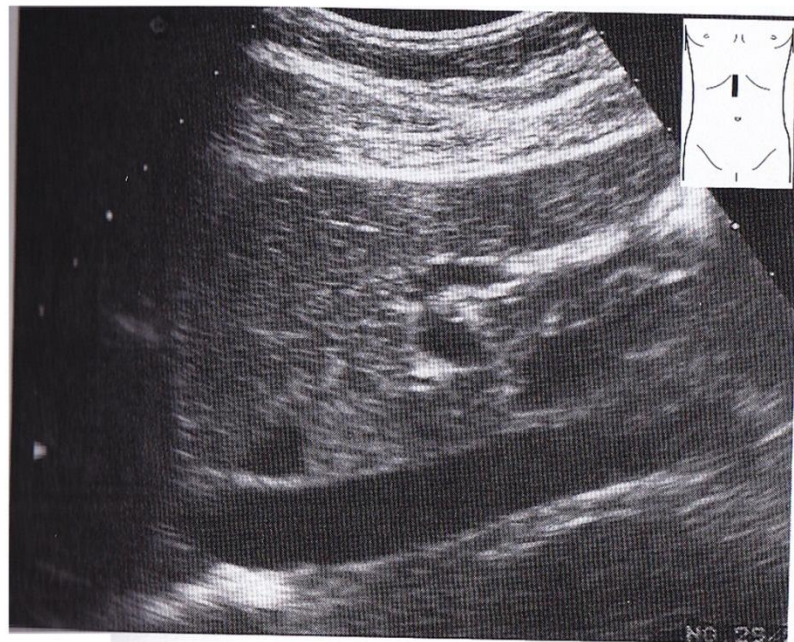




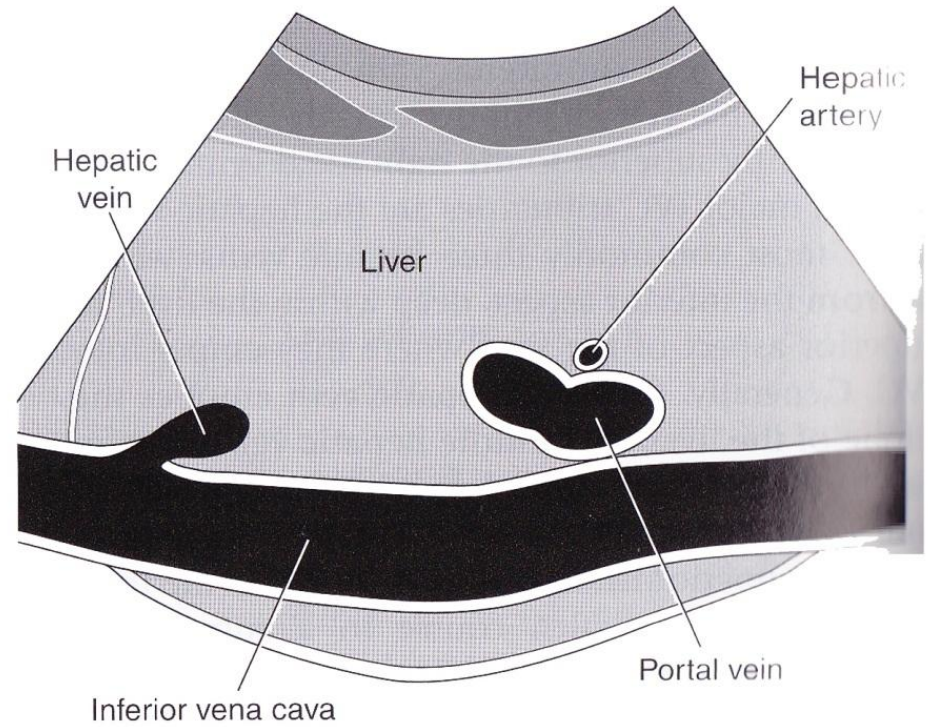
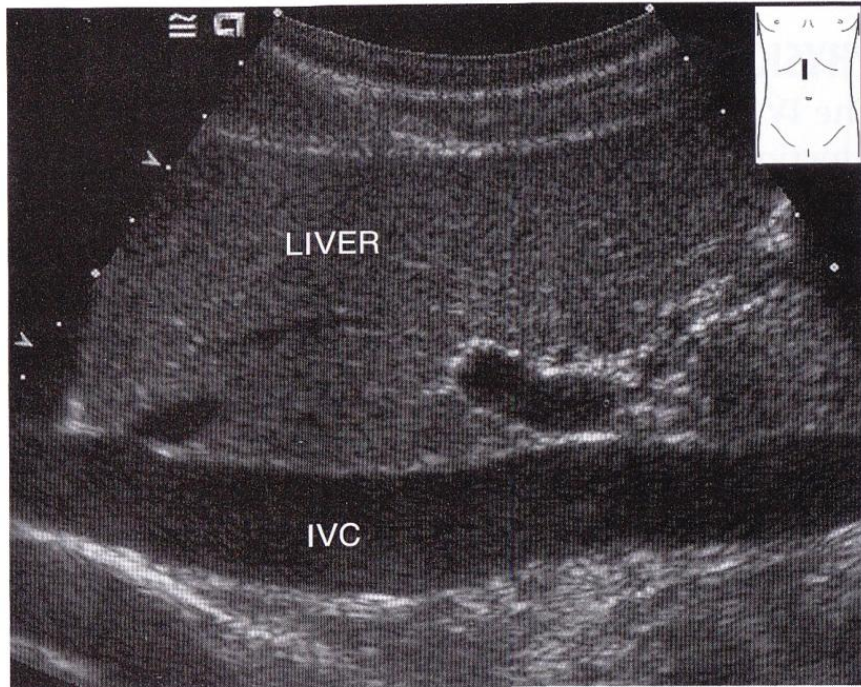




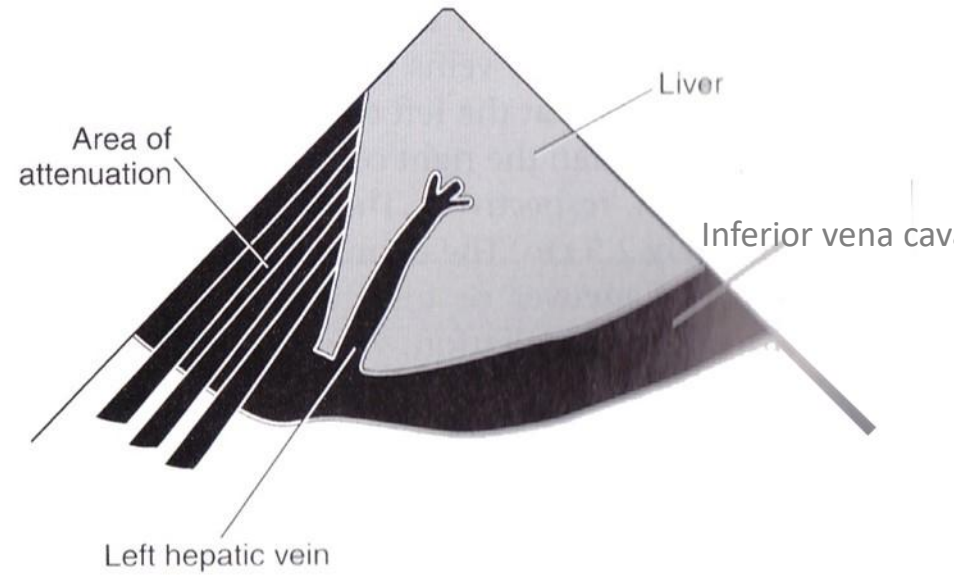
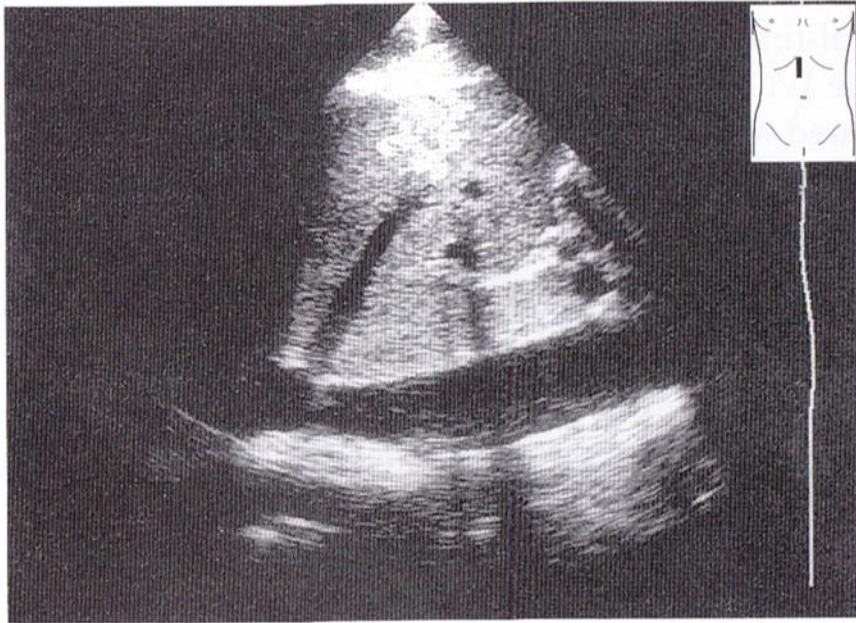
# Epi gastric Sub-Costal Window



# Right Epigastric Window



# Right Sub-Costal Window



# Right Sub Costal Horizontal Window

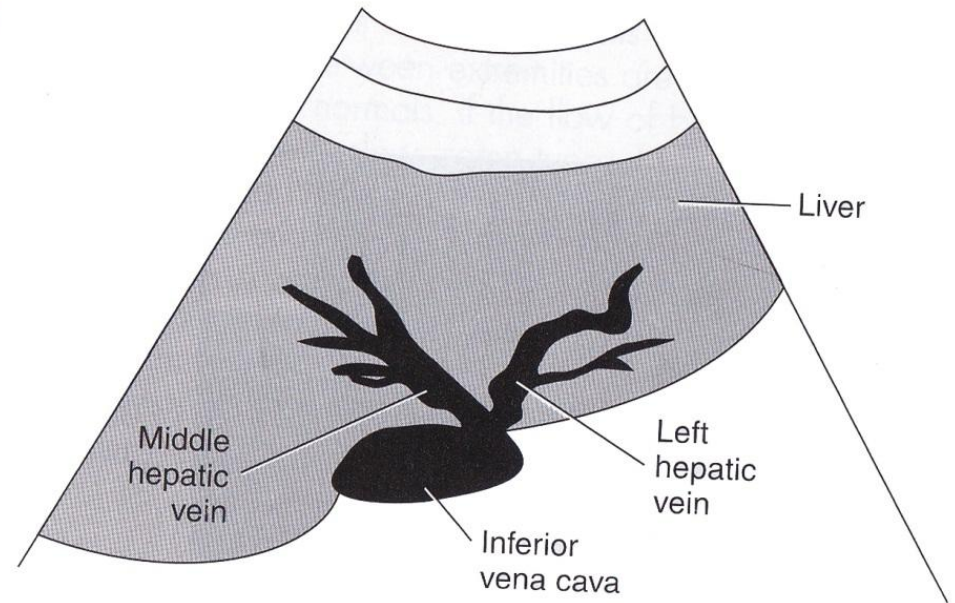
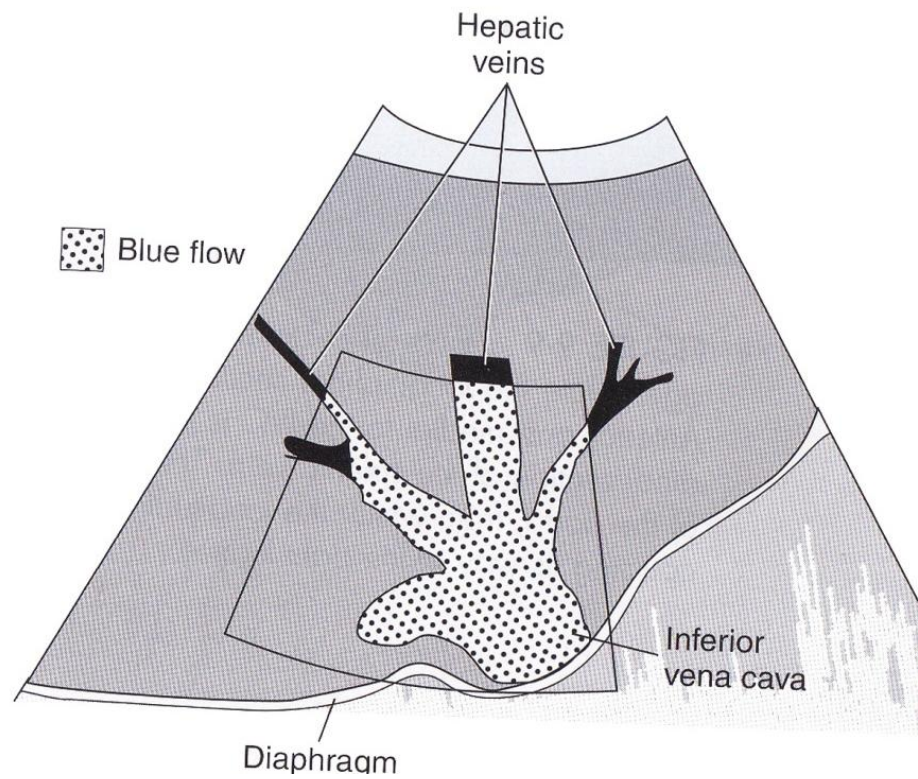
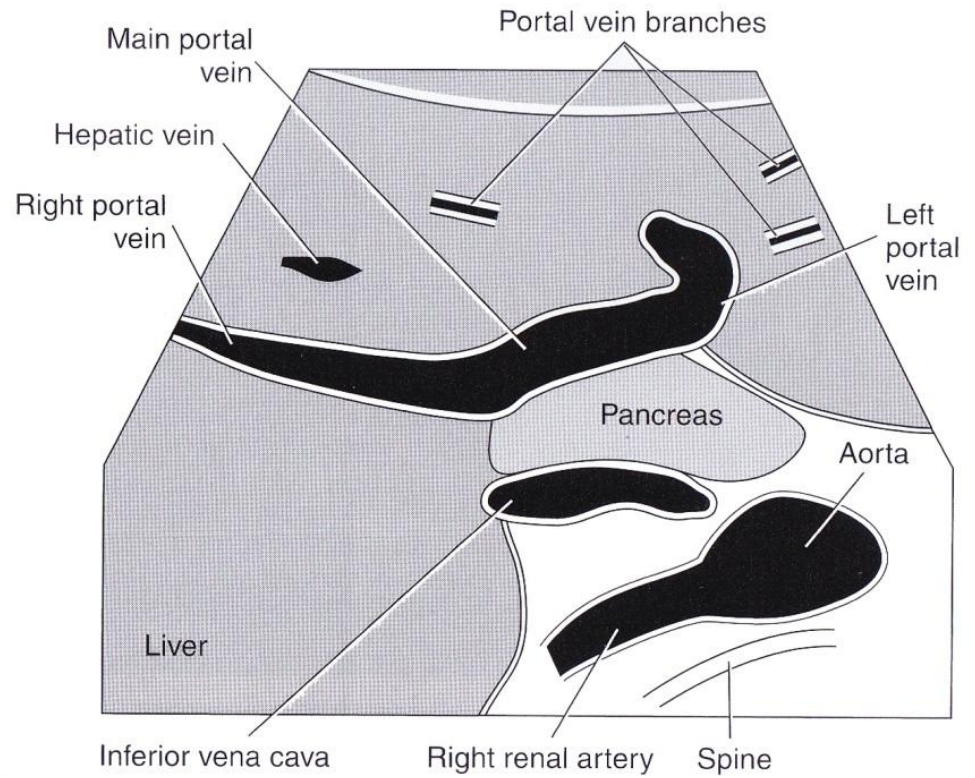


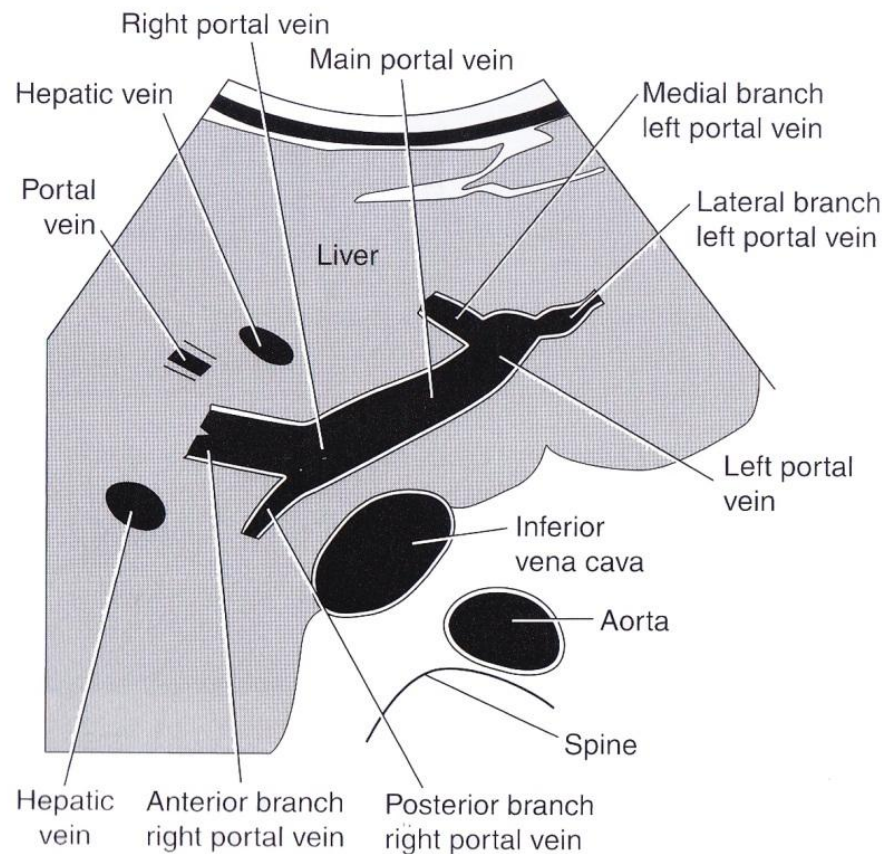
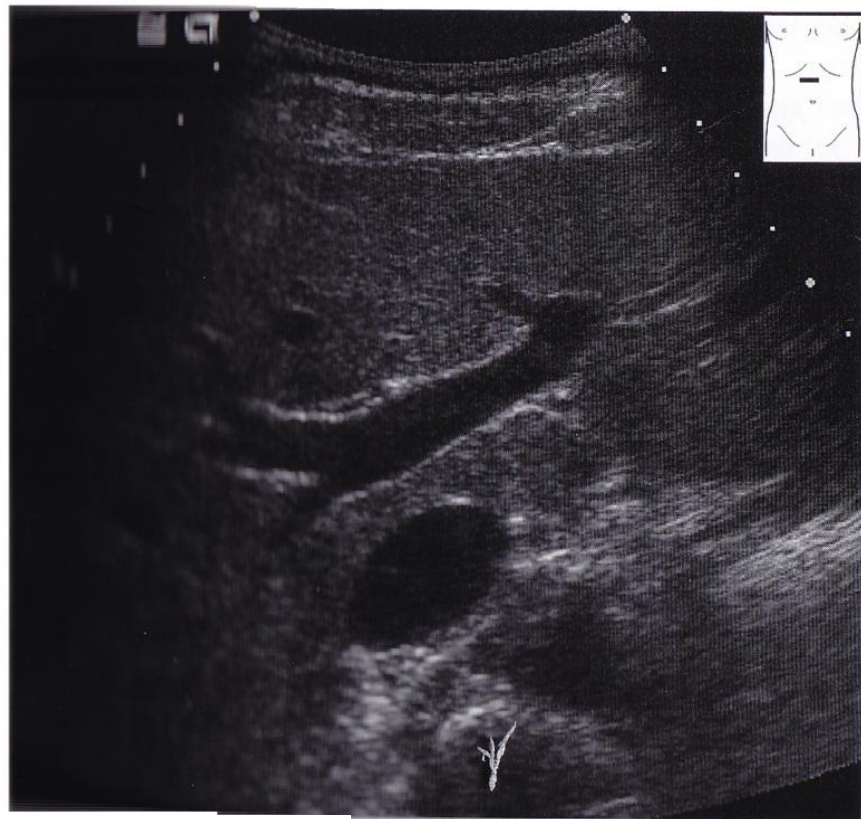


FIGURE 27

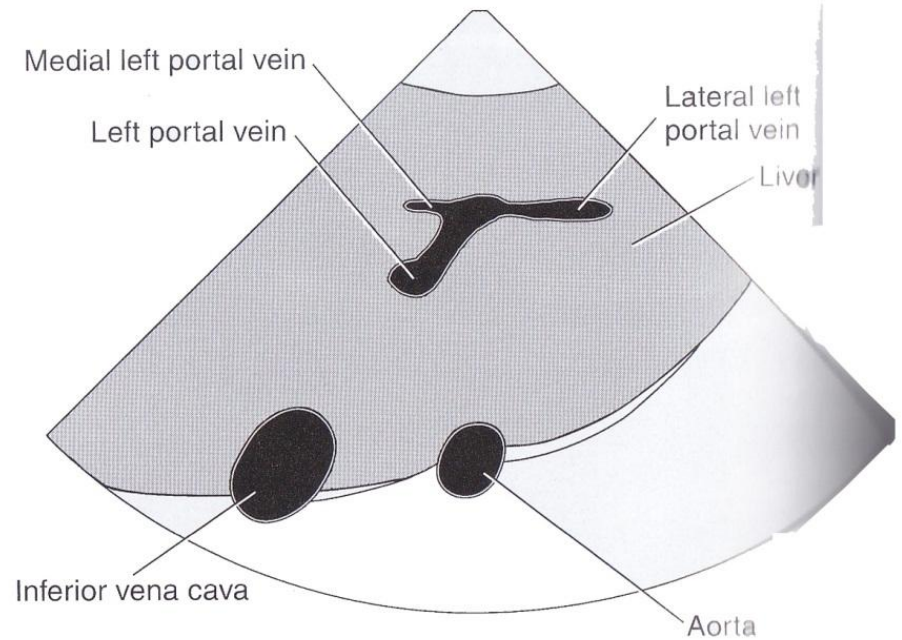
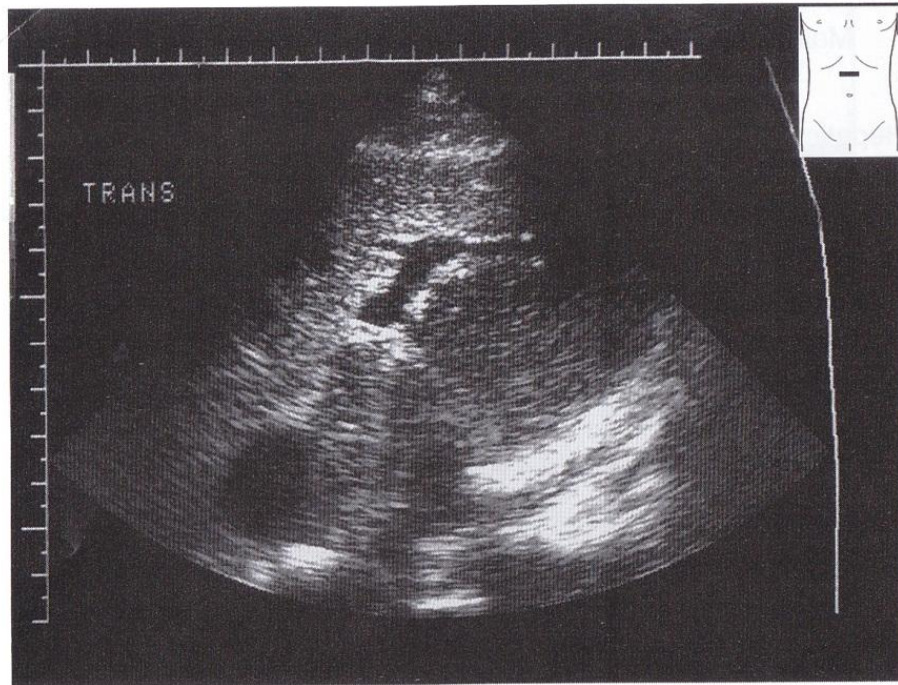




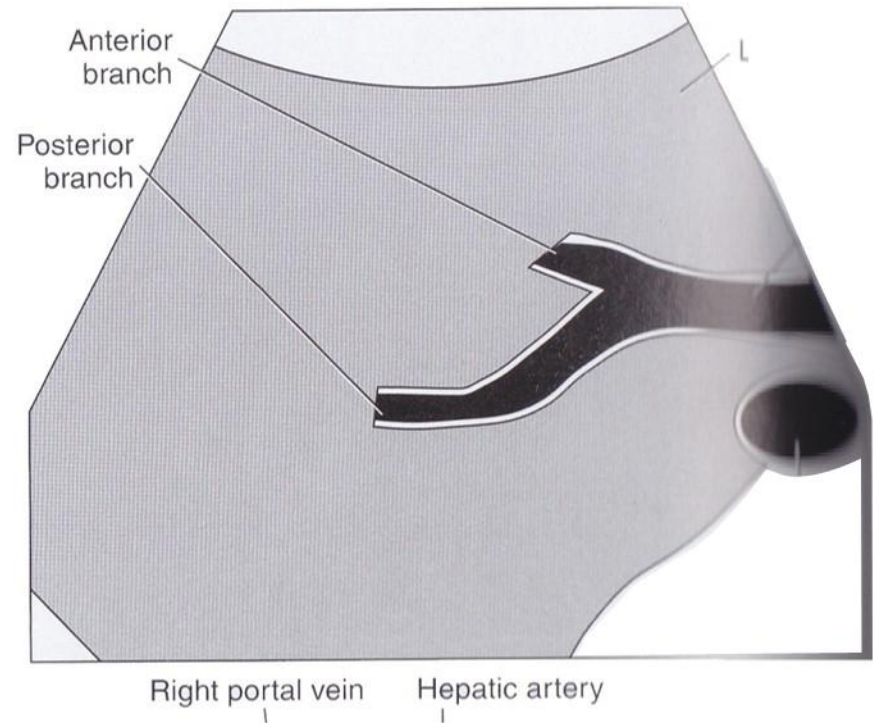
# Right Sub-Costal Horizontal Window



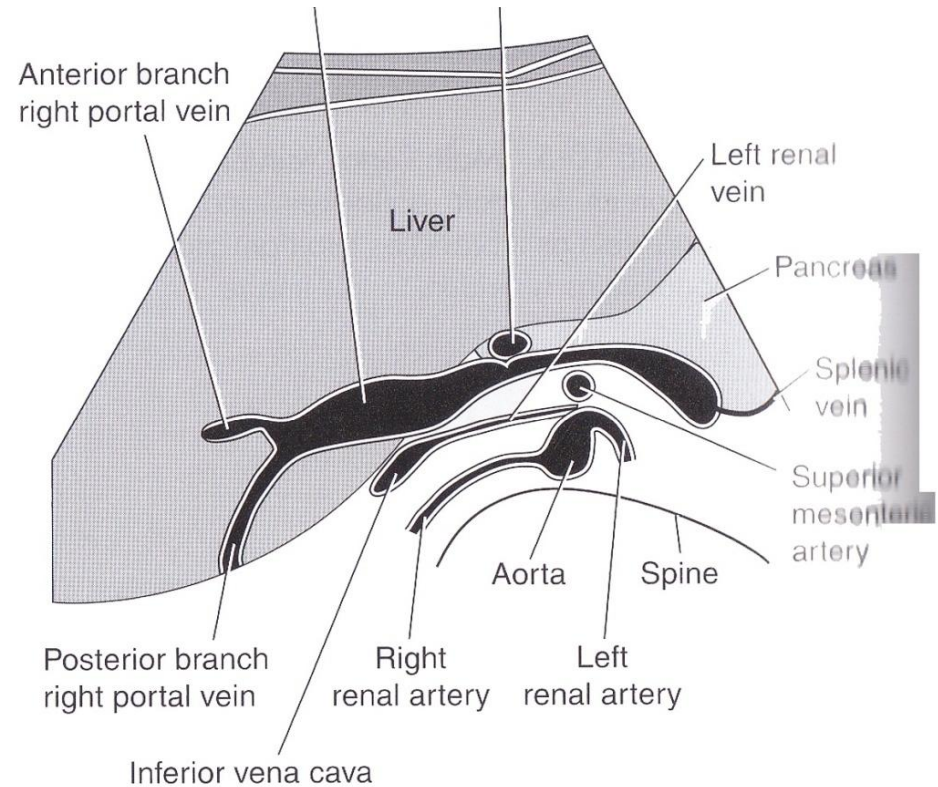
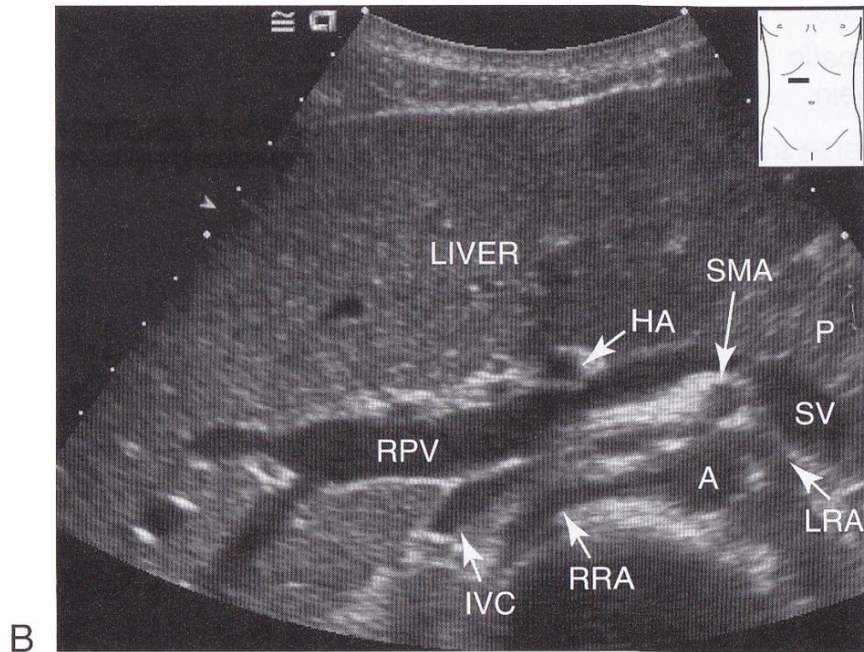
# Right Epigastric Horizontal Window



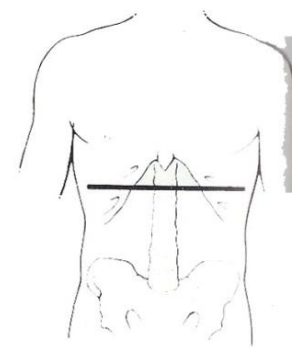
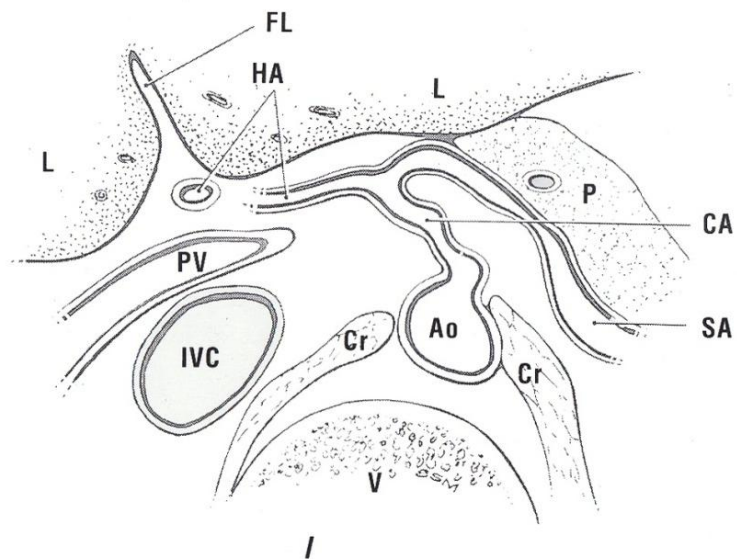
# Right Sub-Costal Horizontal Window



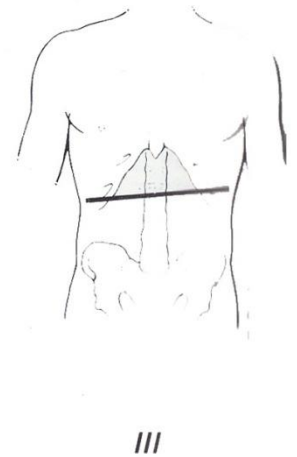
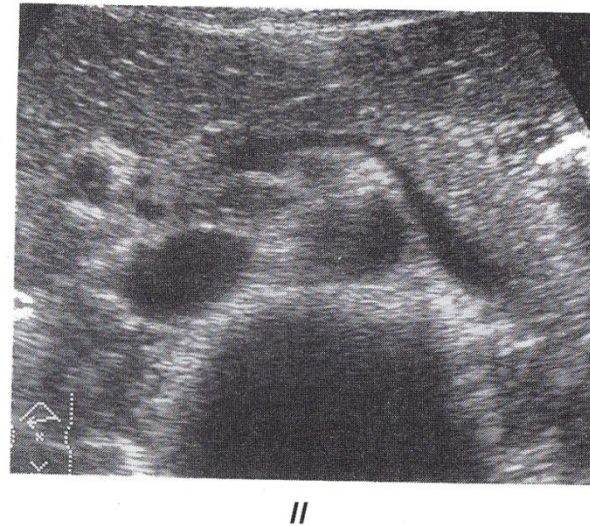
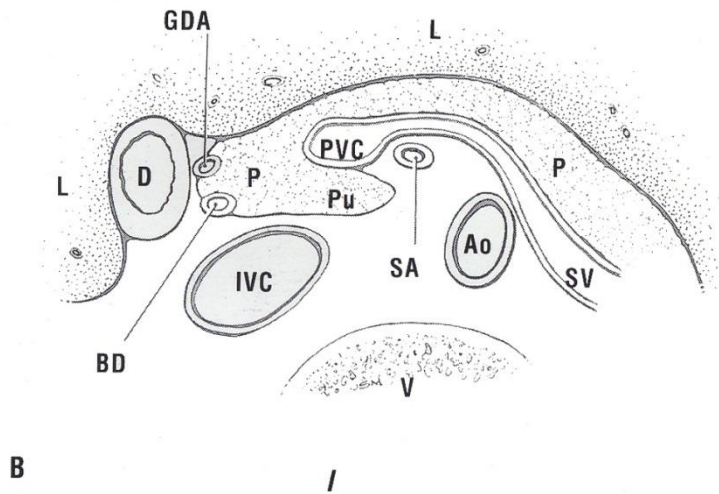
# Right Epigastric Horizontal Window



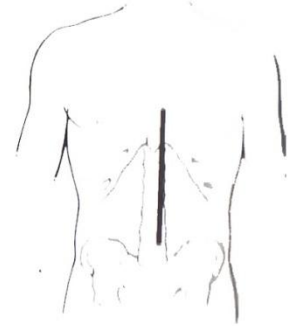
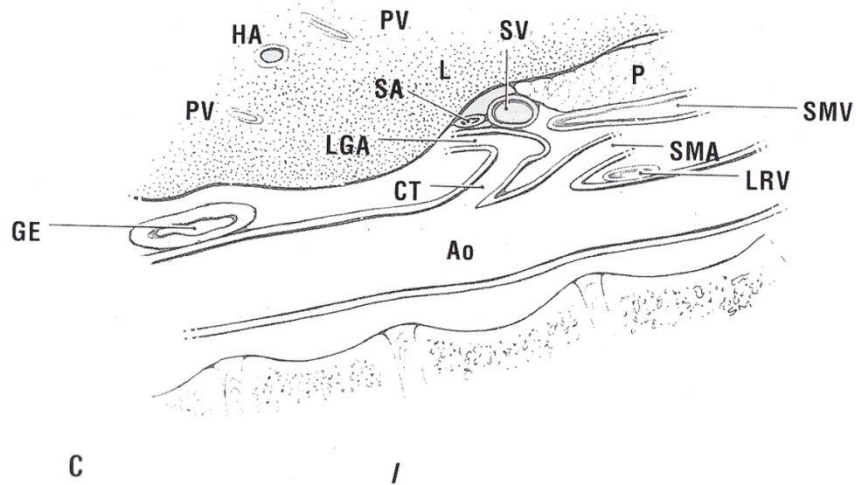
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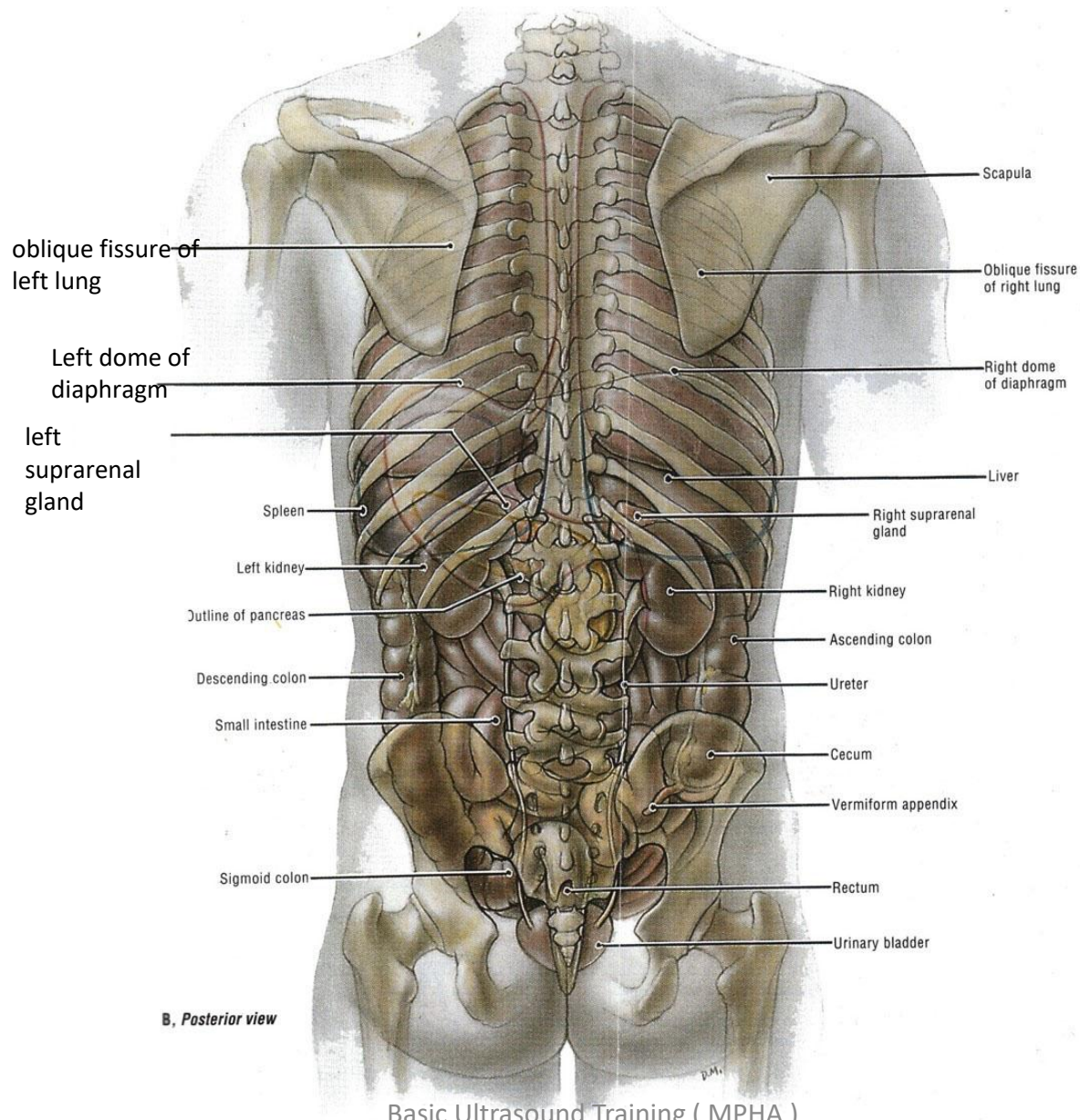
# Epigastric Window

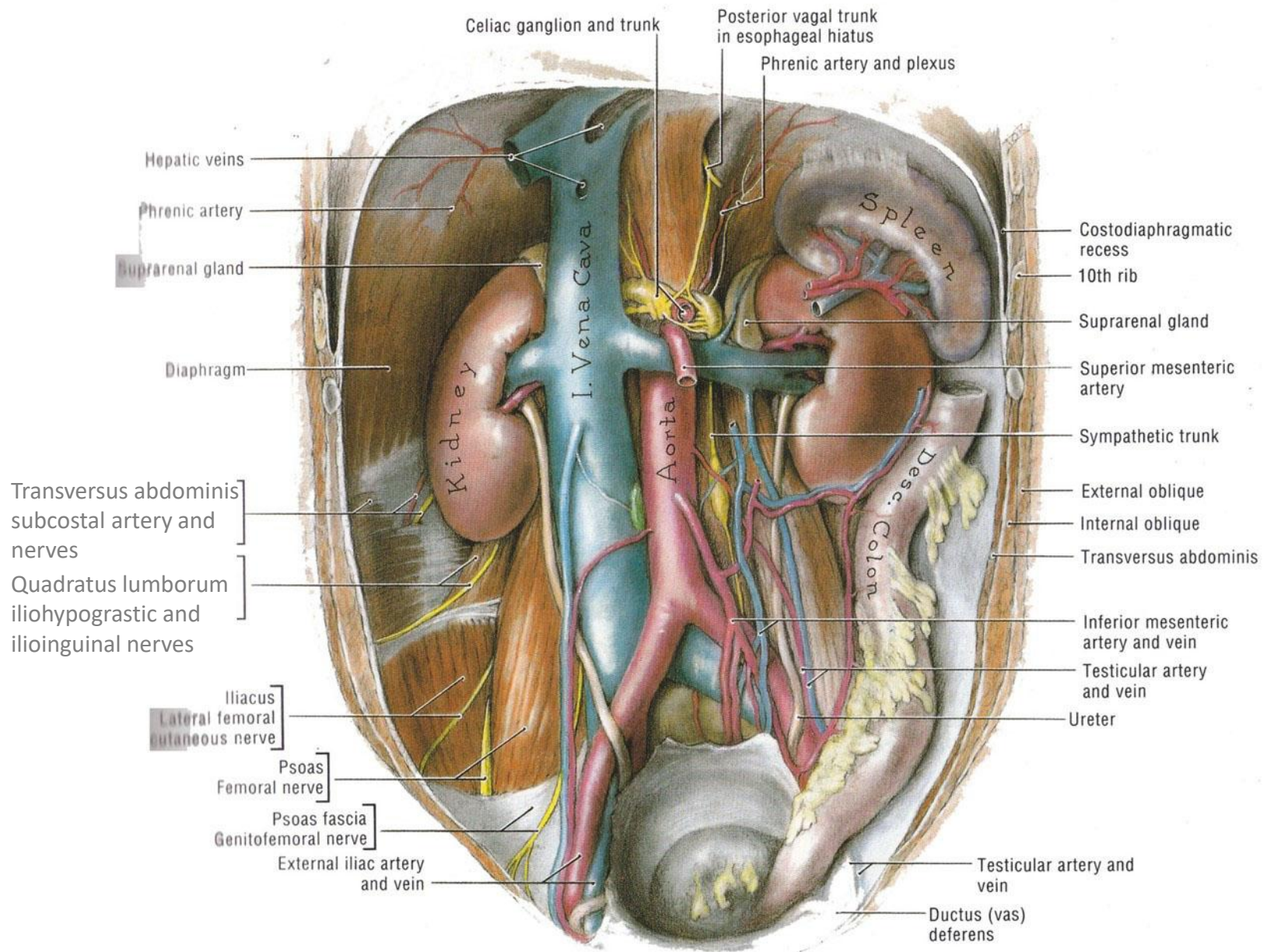


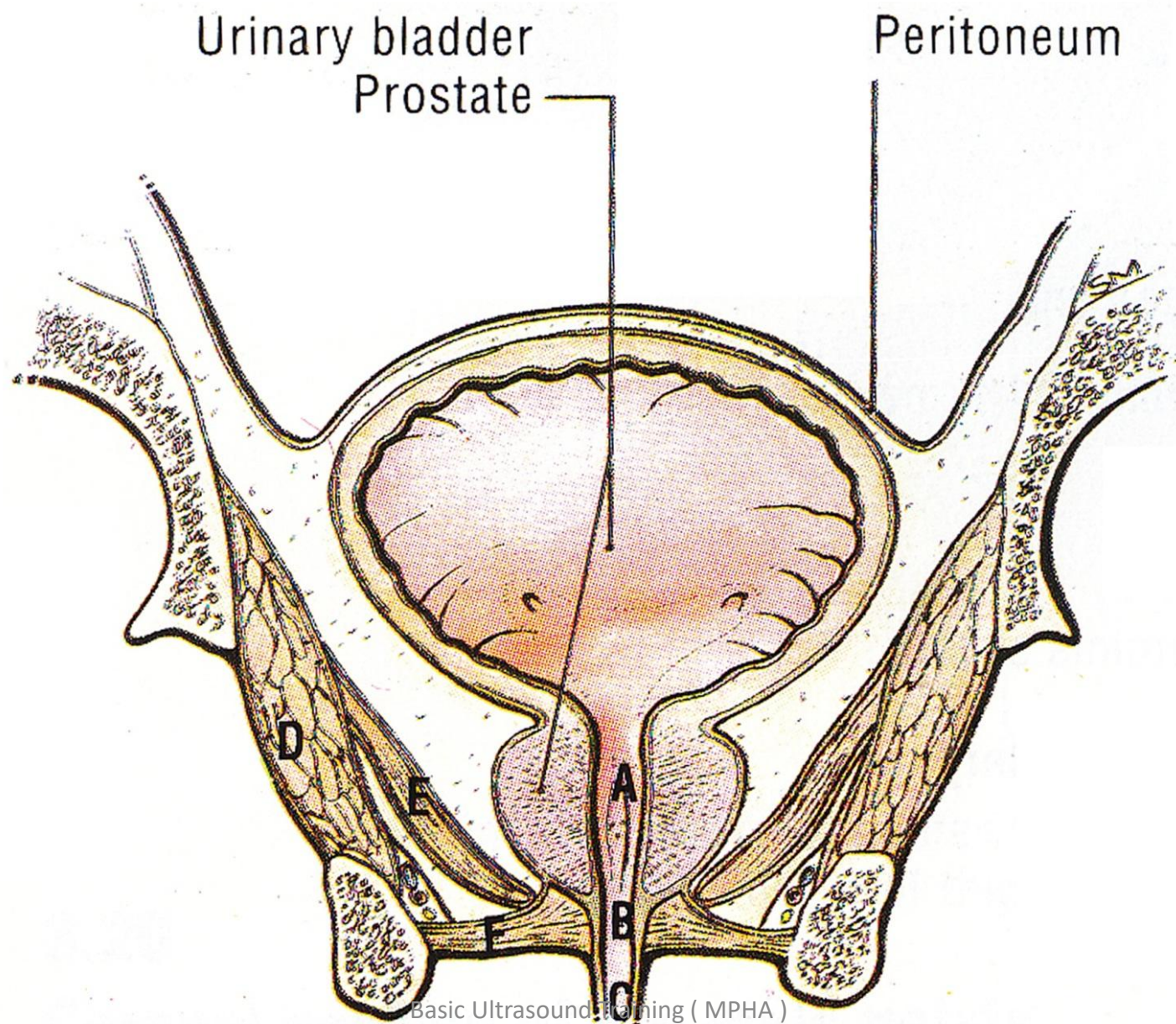
# Left Epigastric Sagittal Window

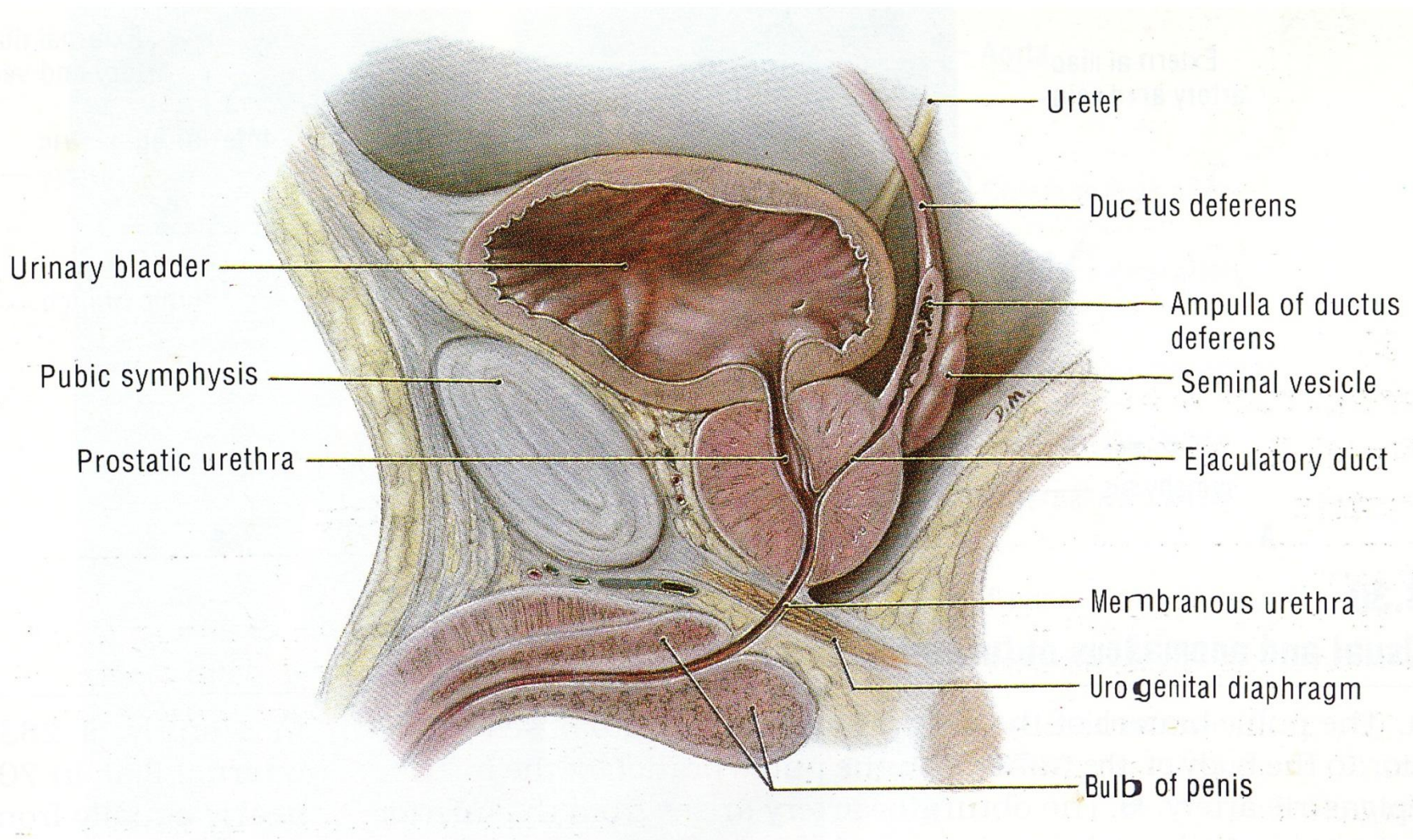


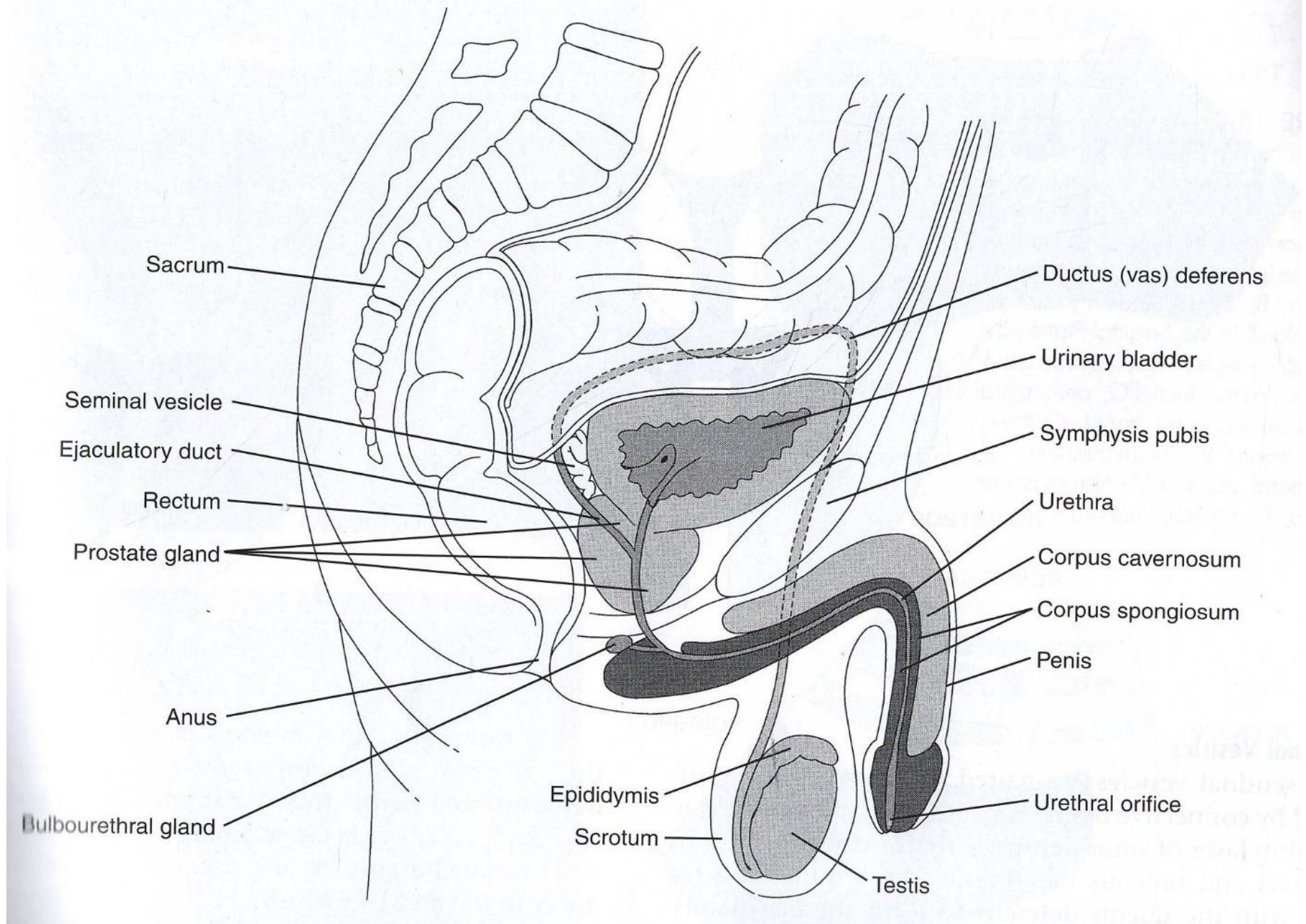
# Urinary System

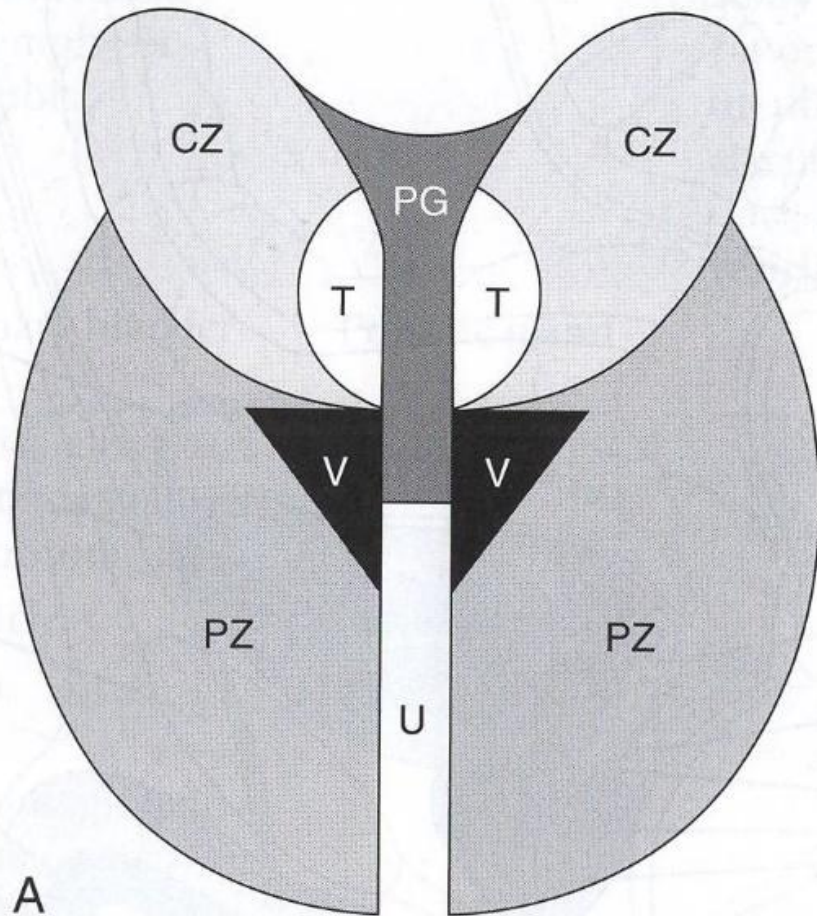




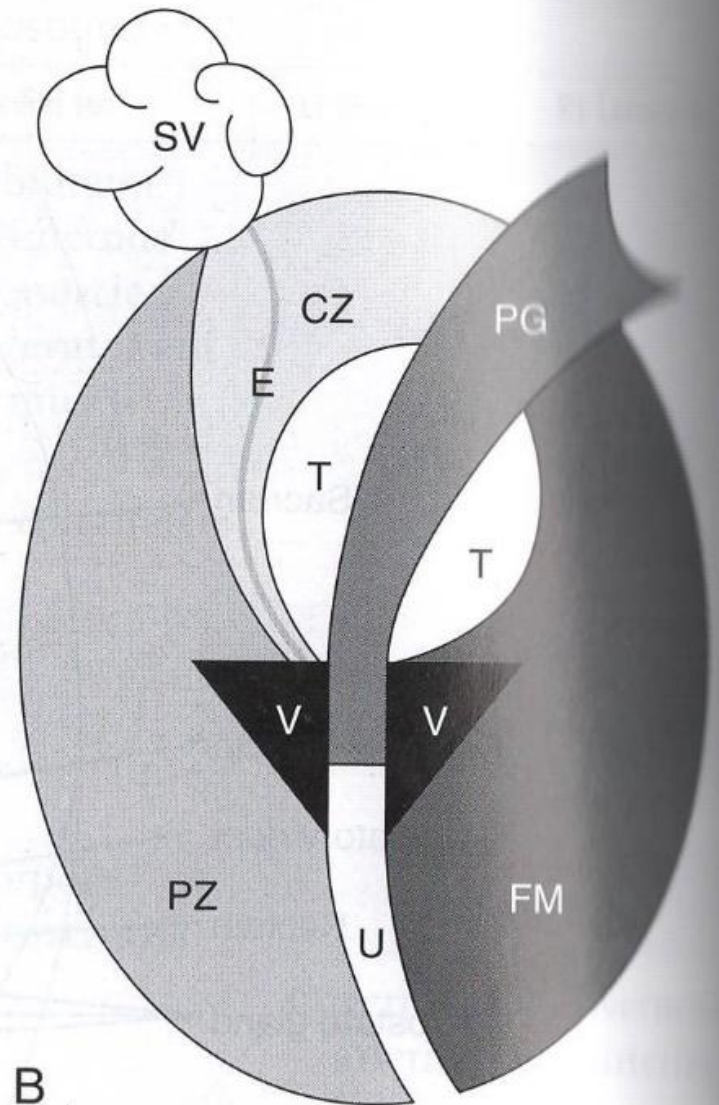




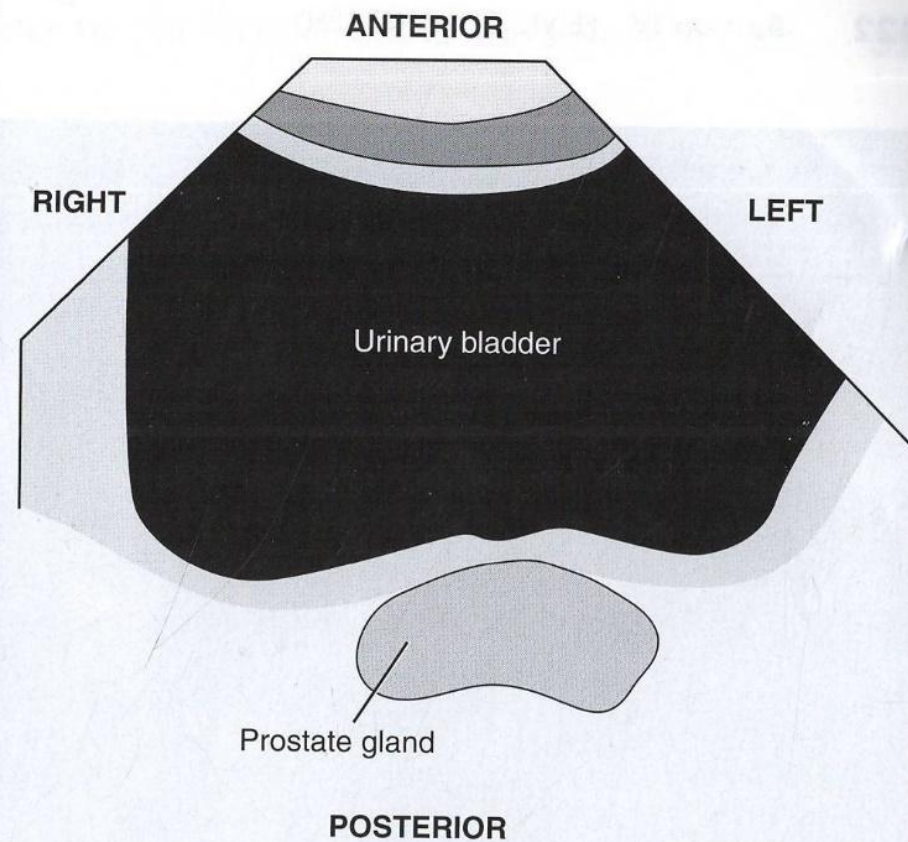
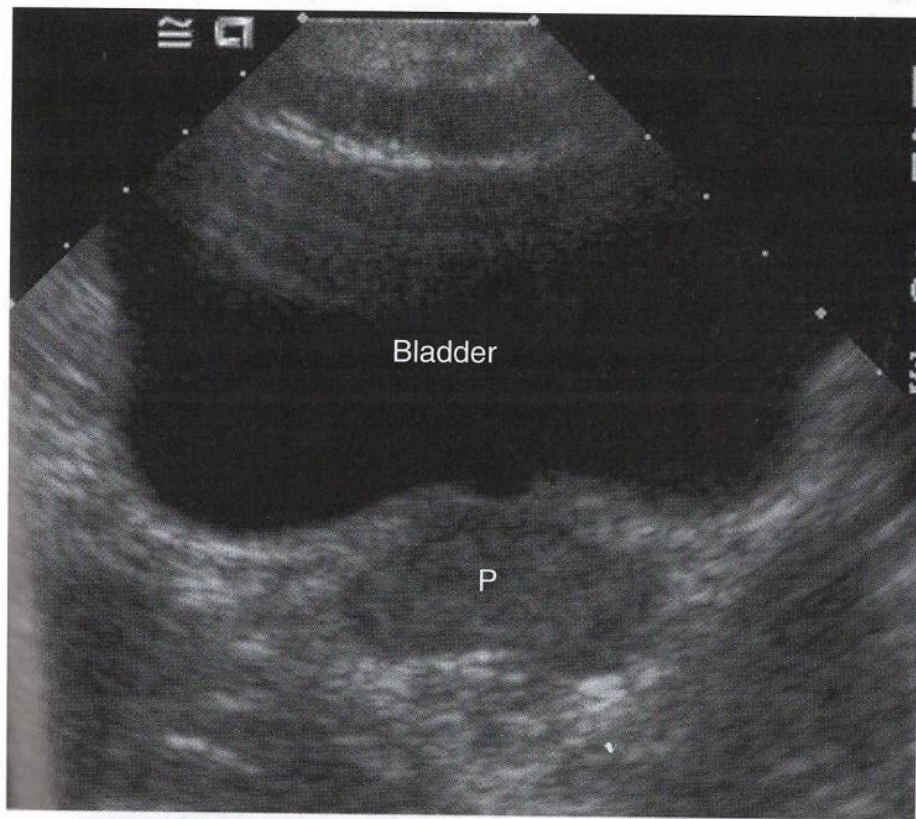


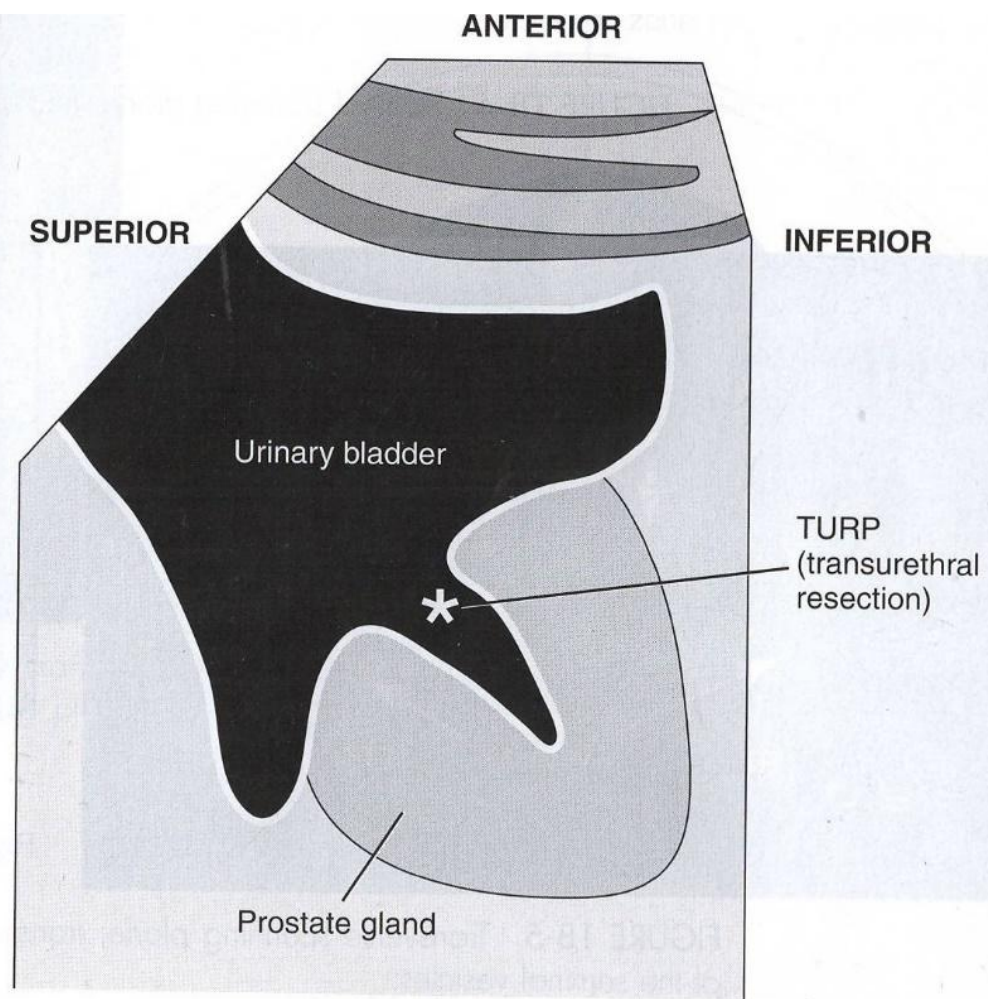


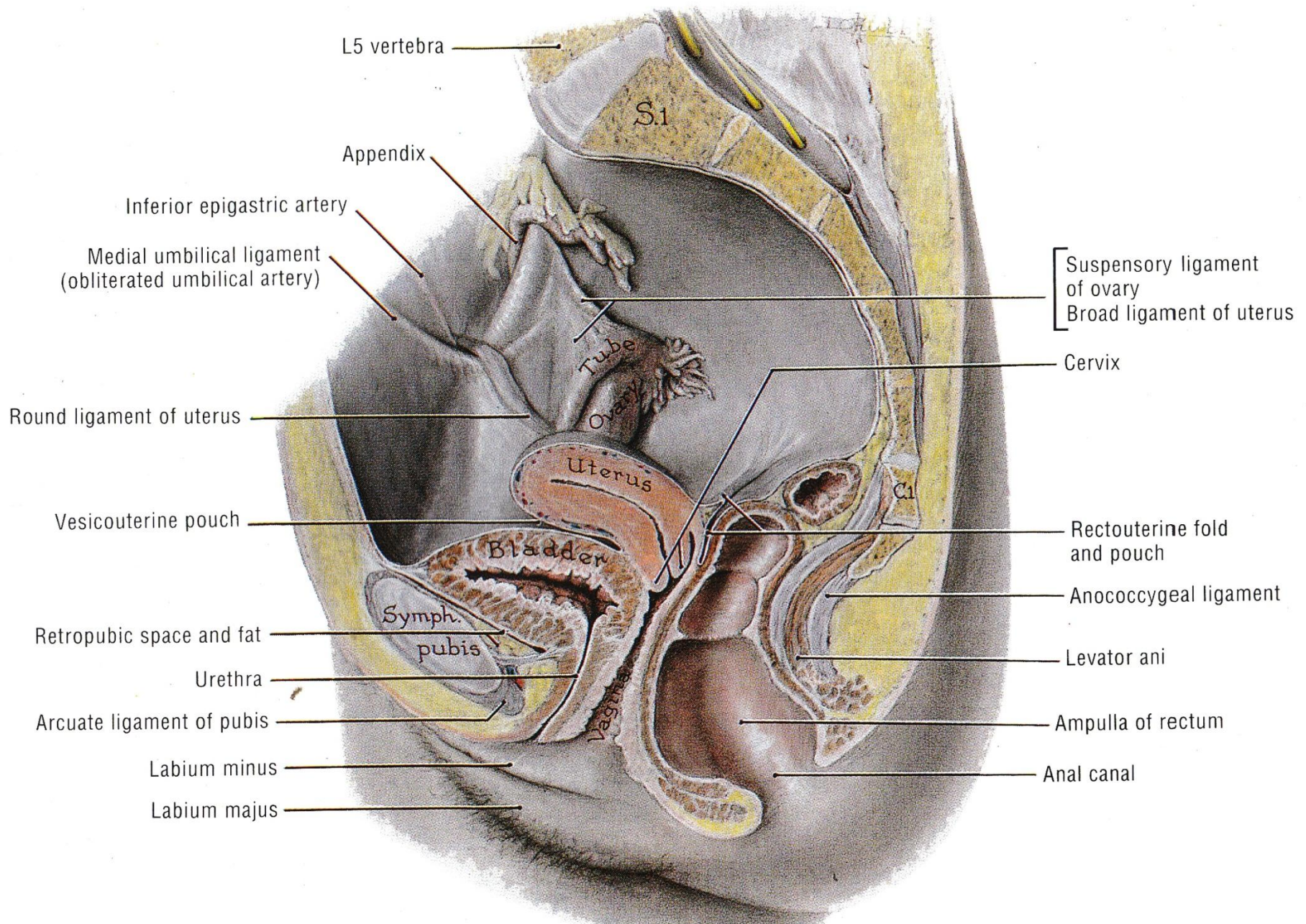
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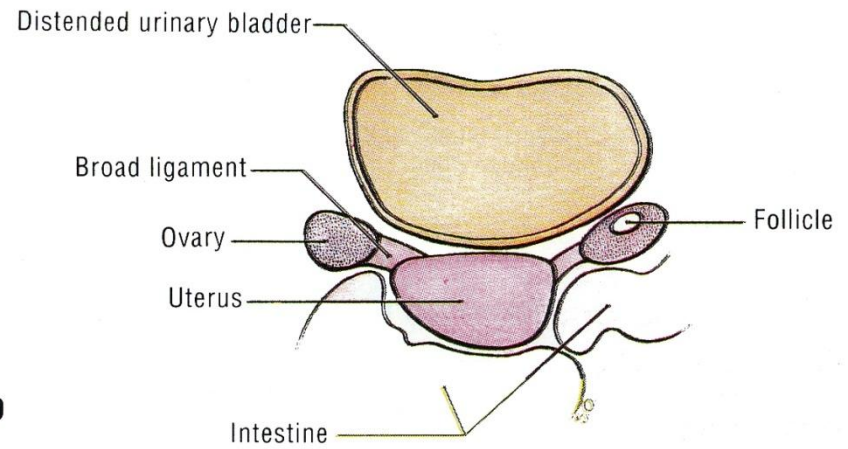
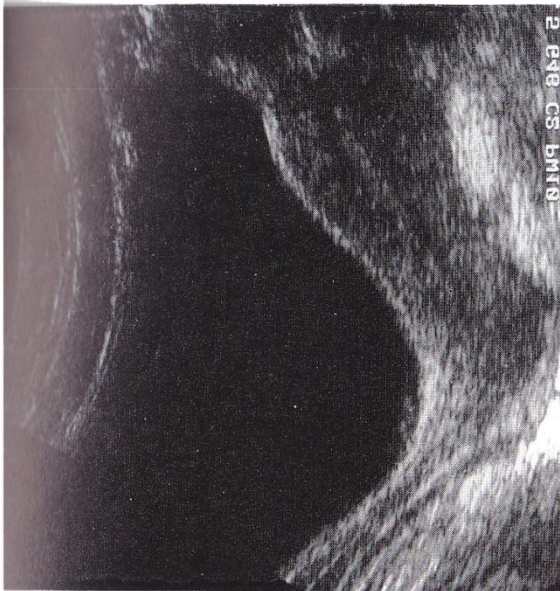
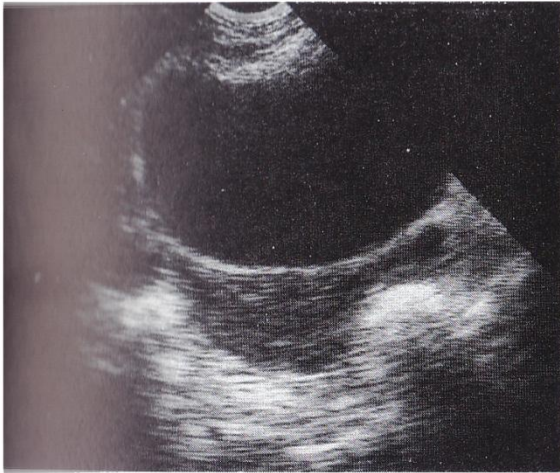


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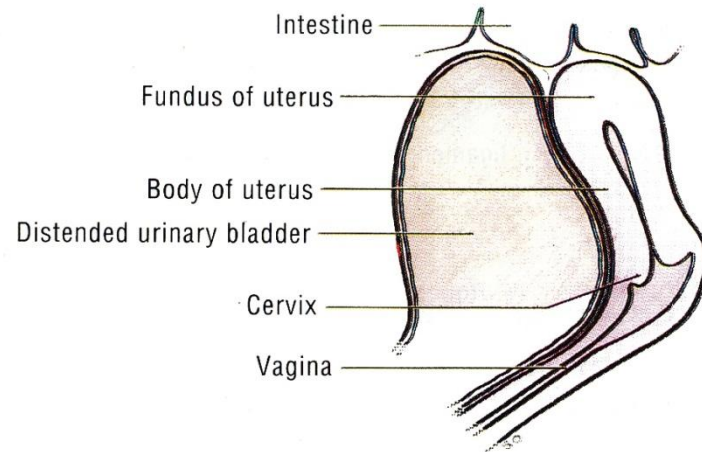




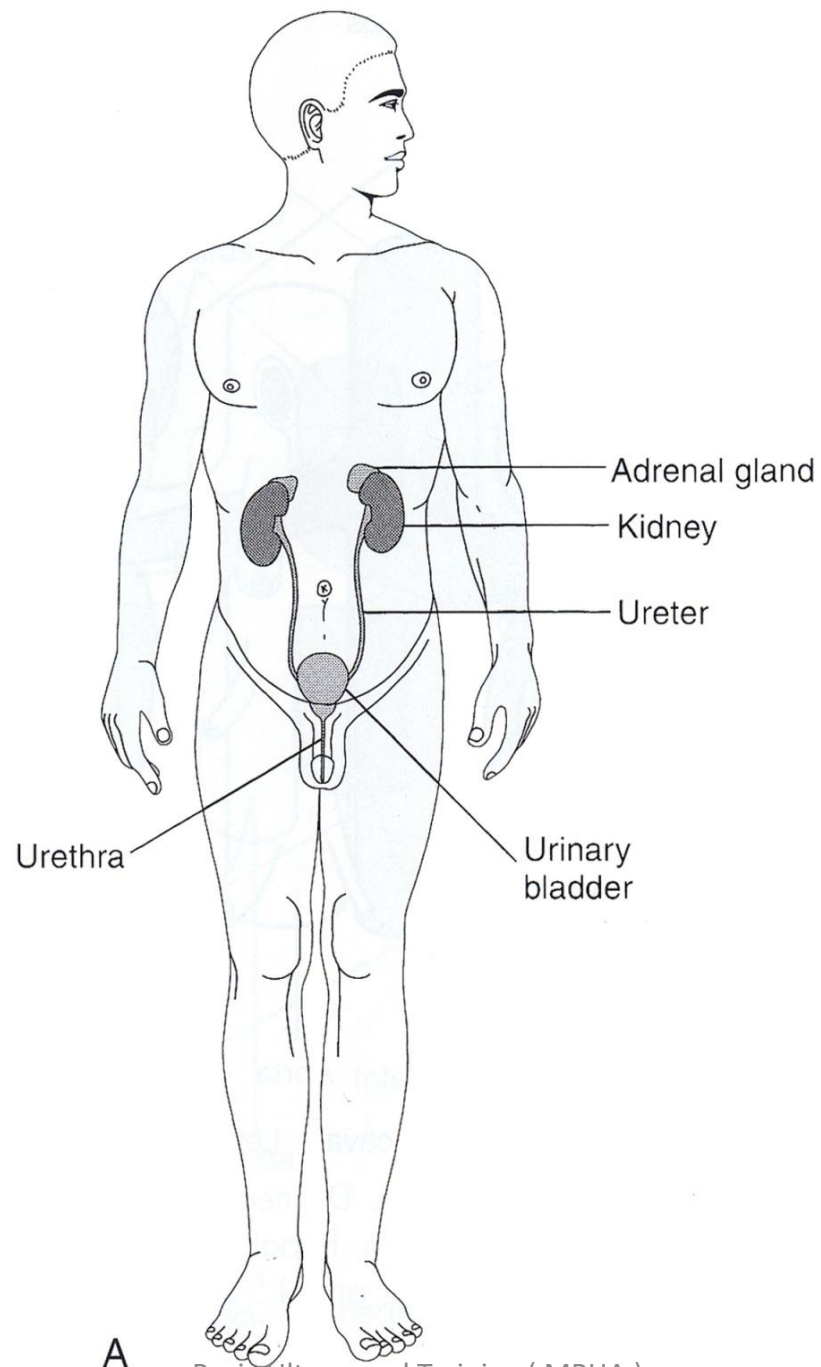




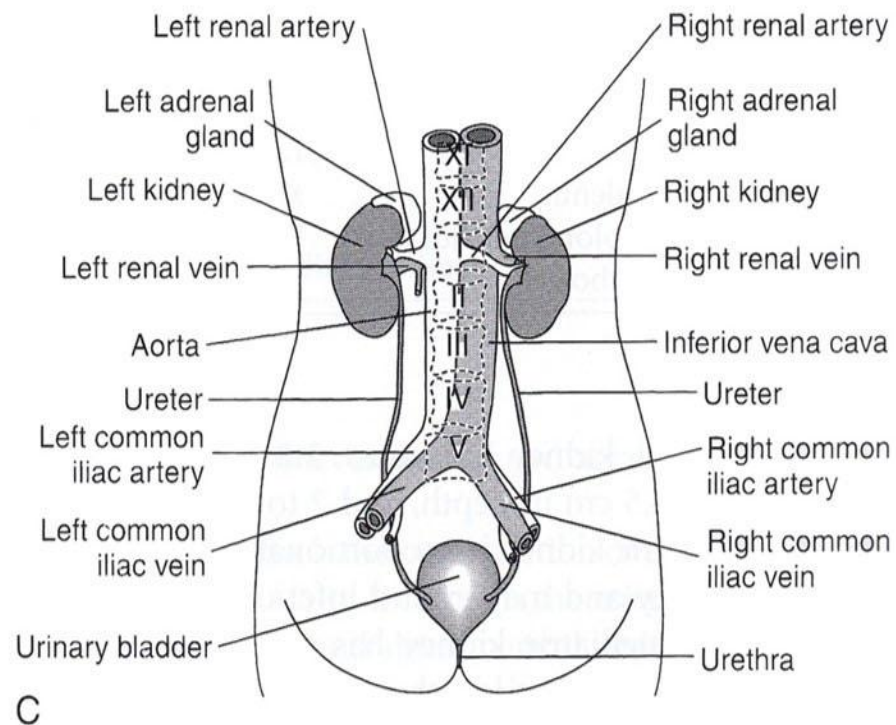
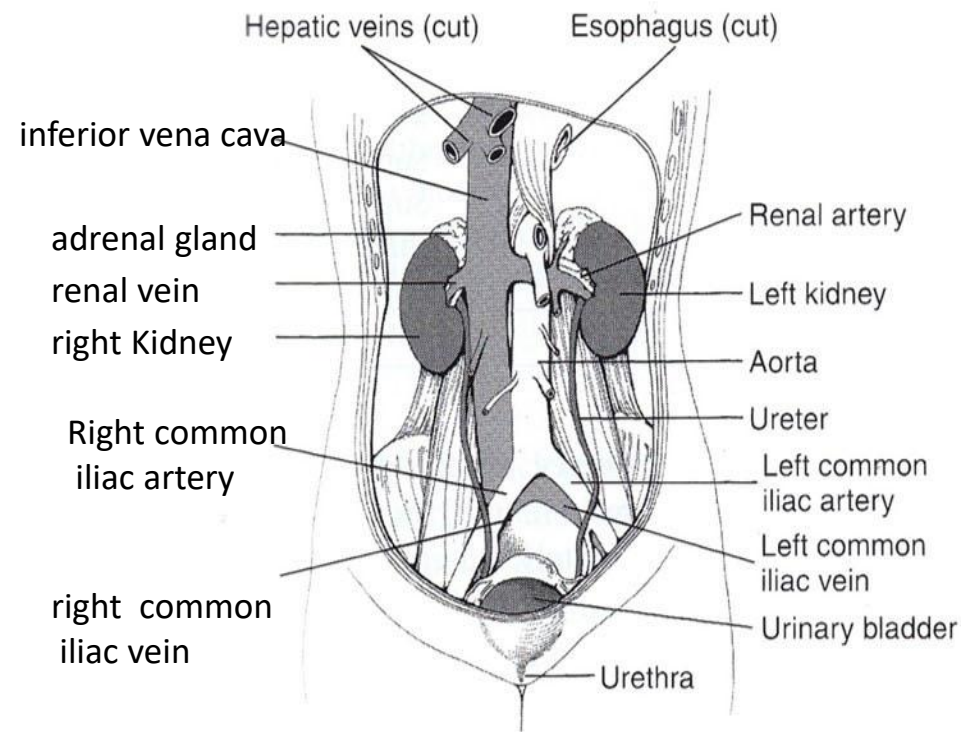
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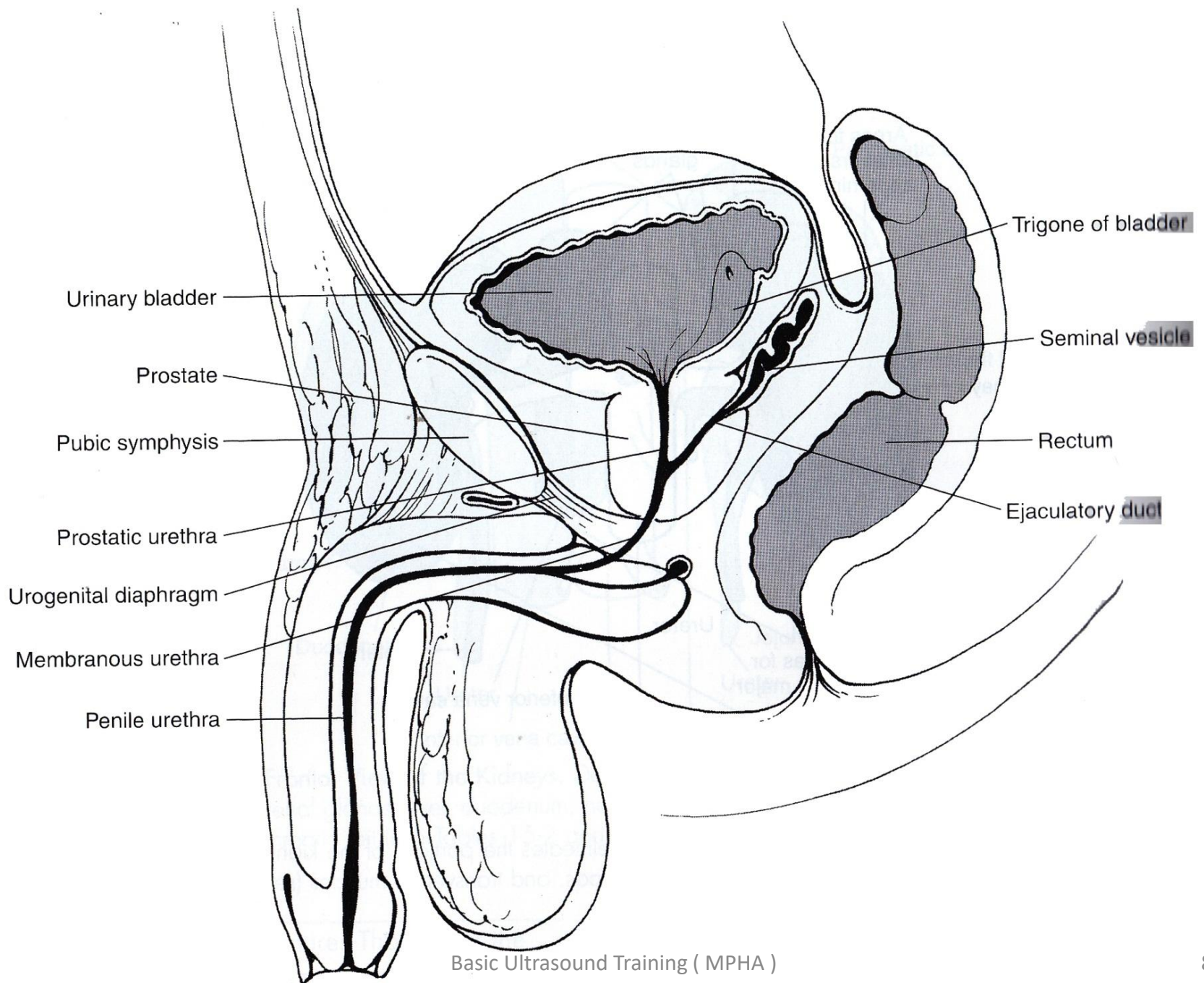


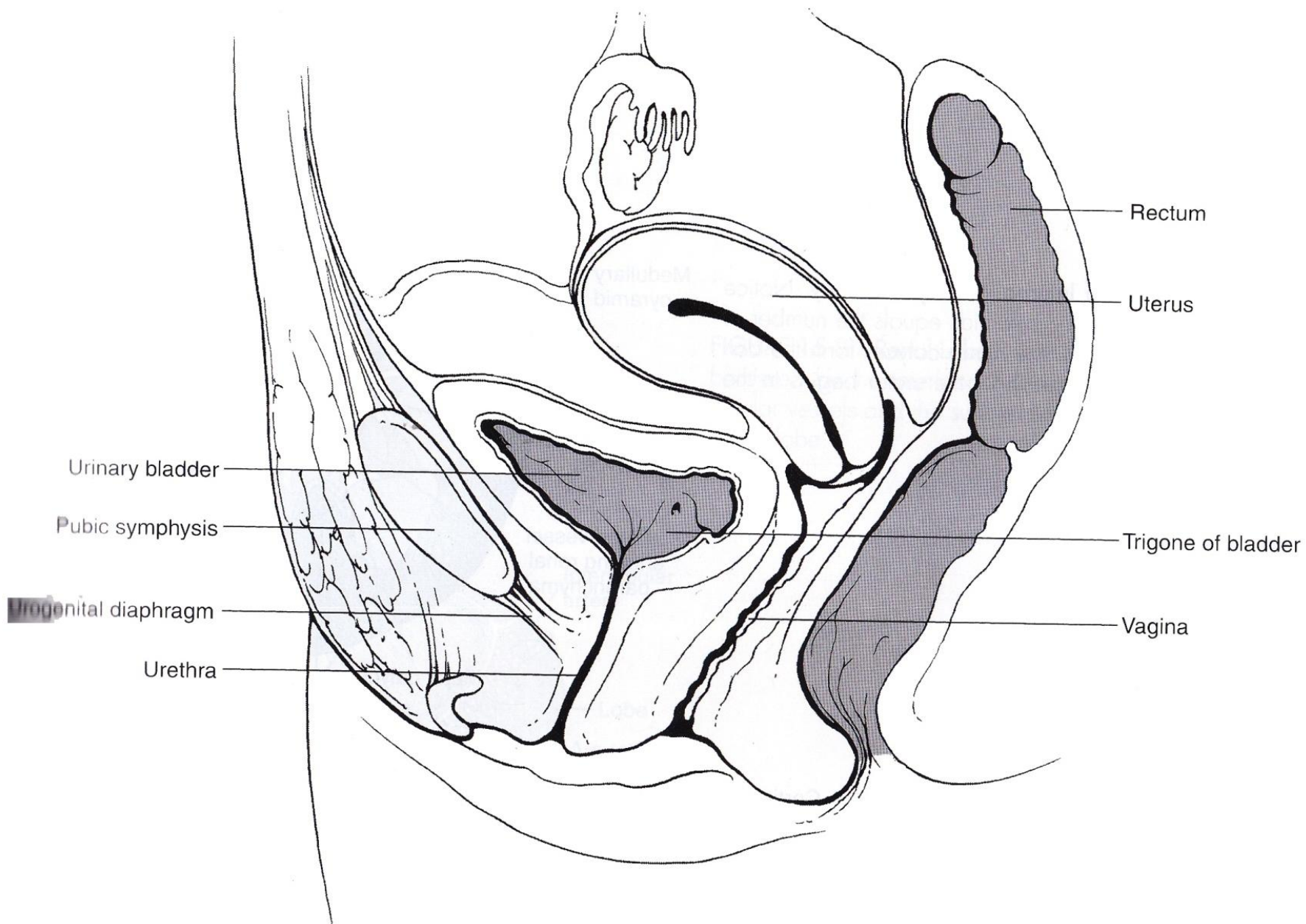
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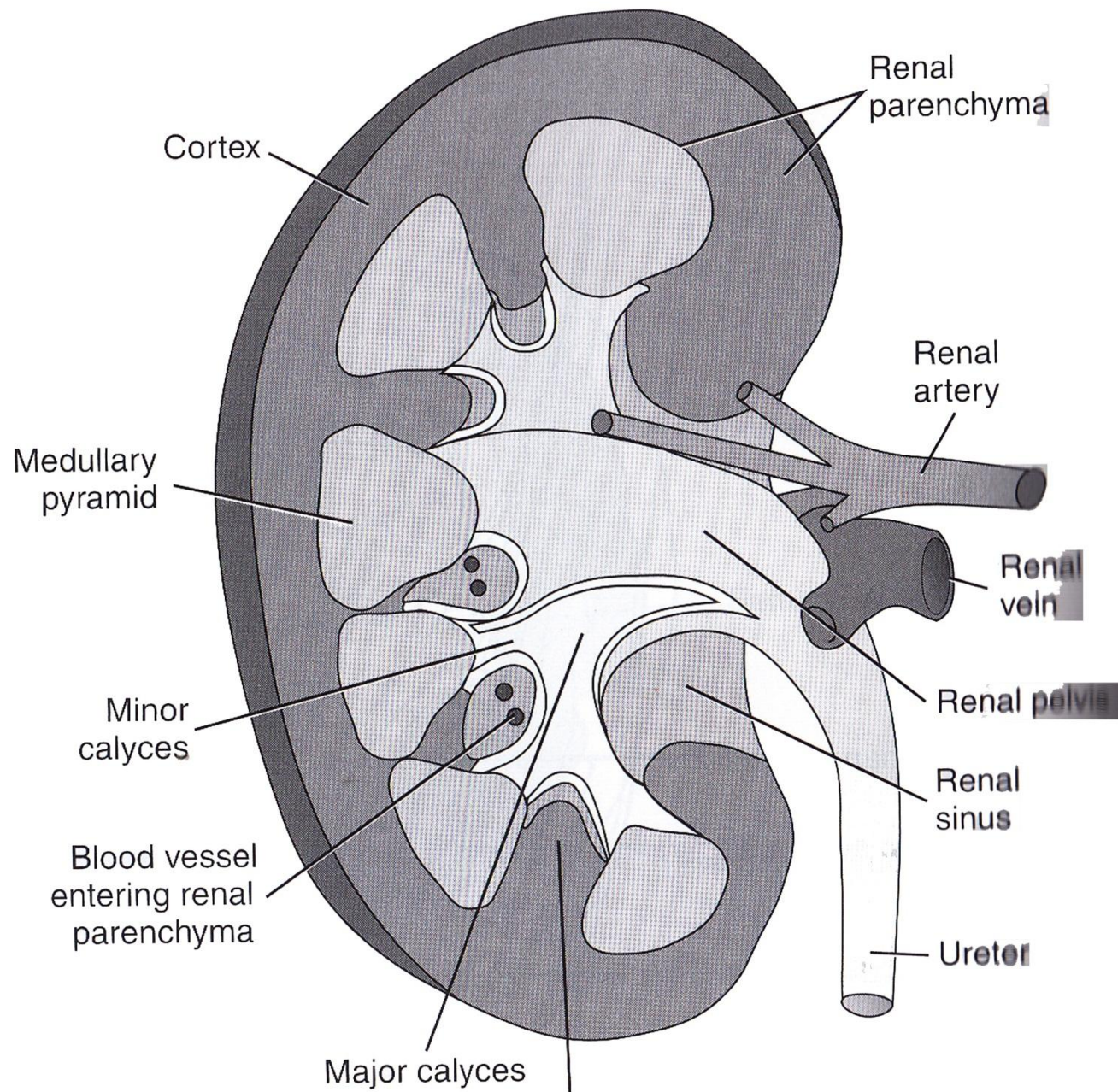


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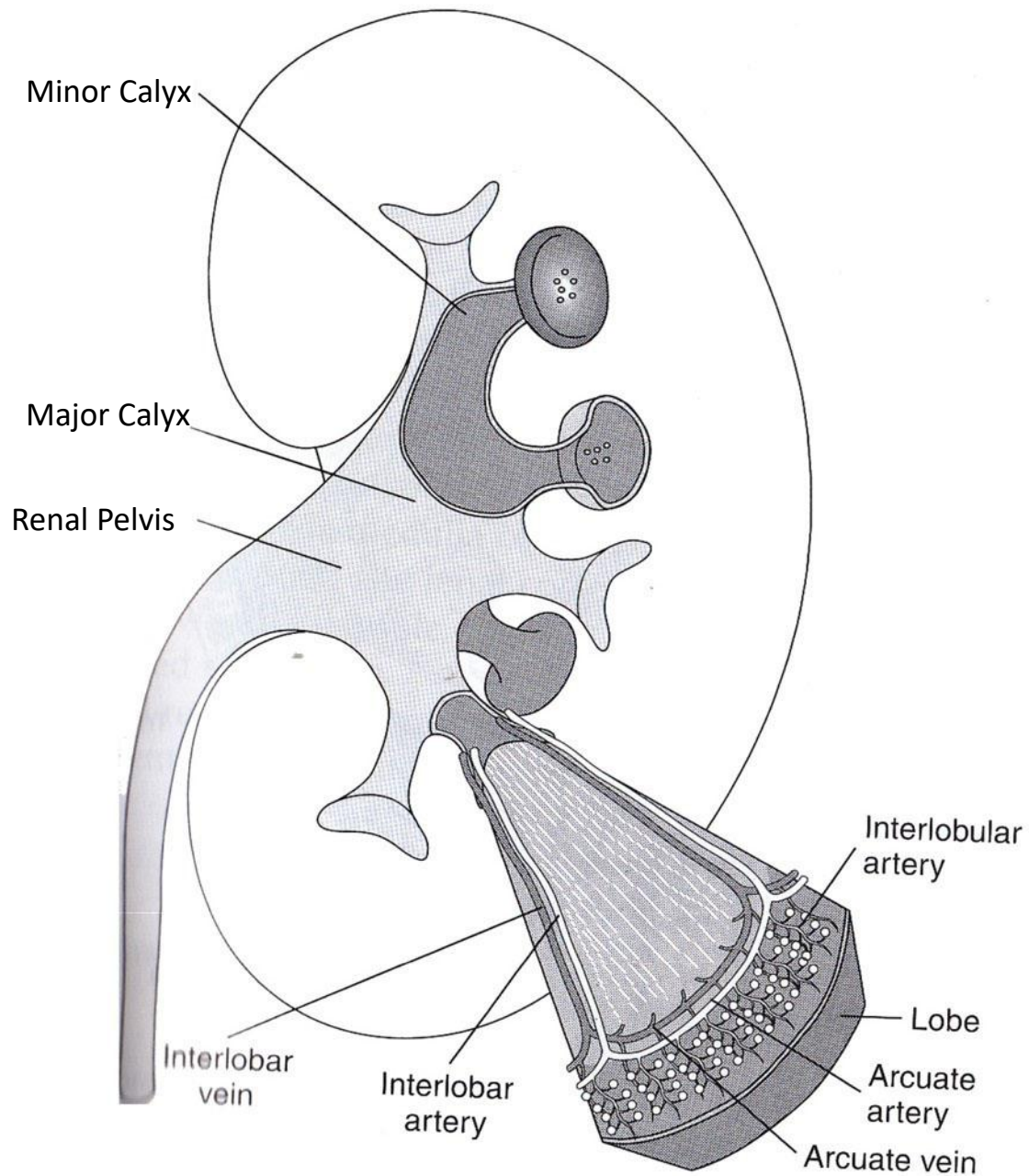


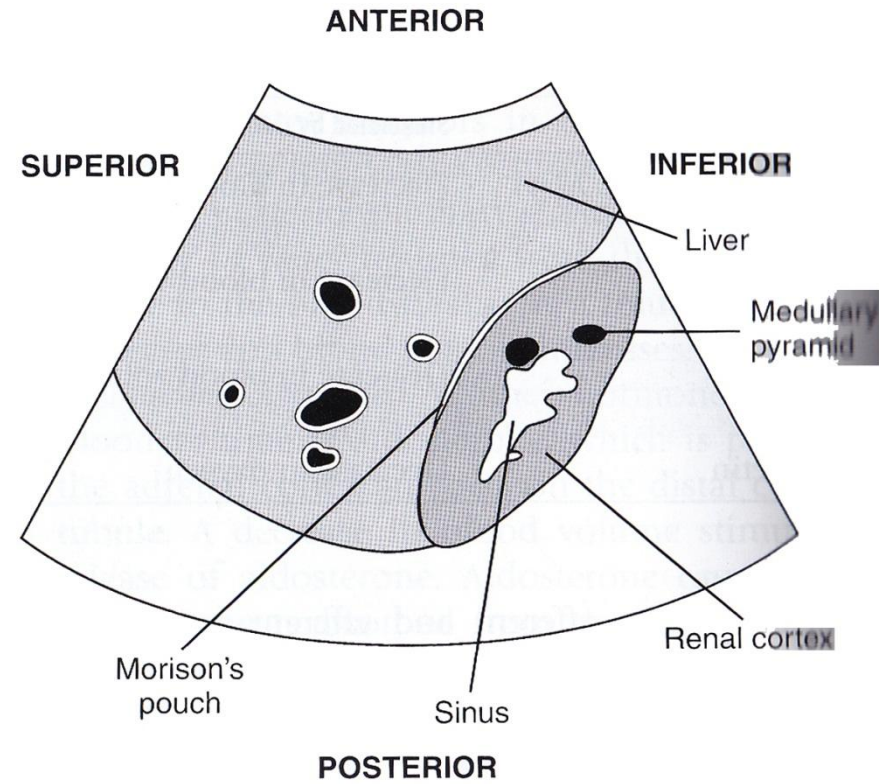
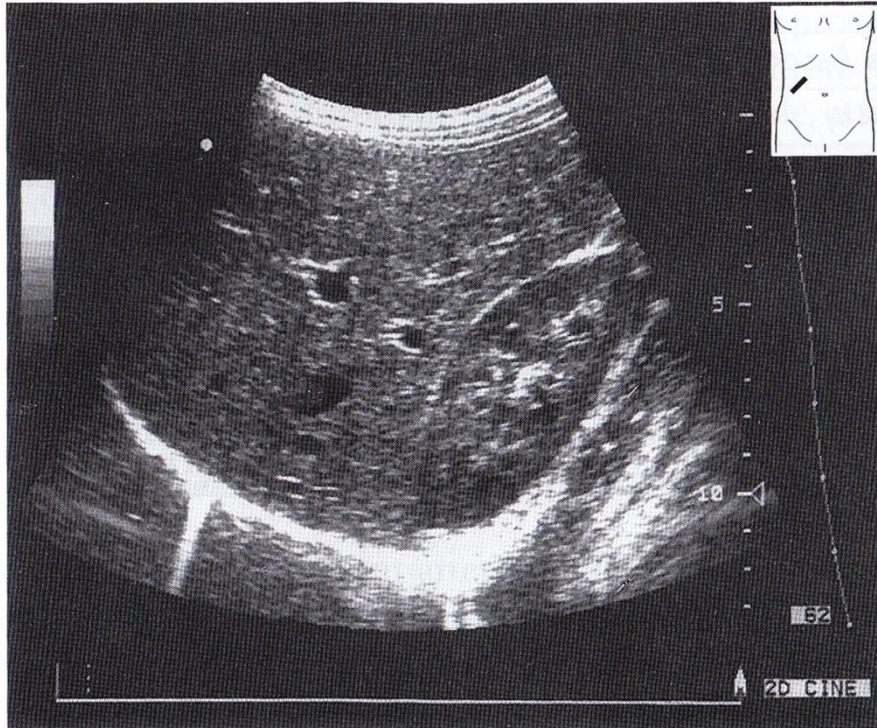


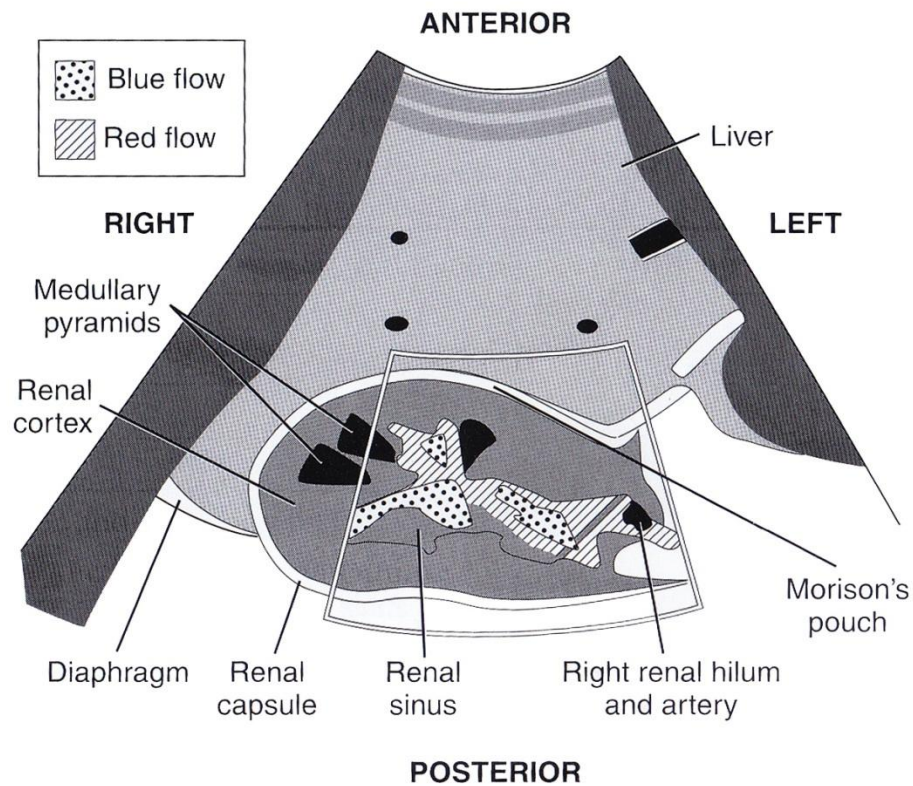
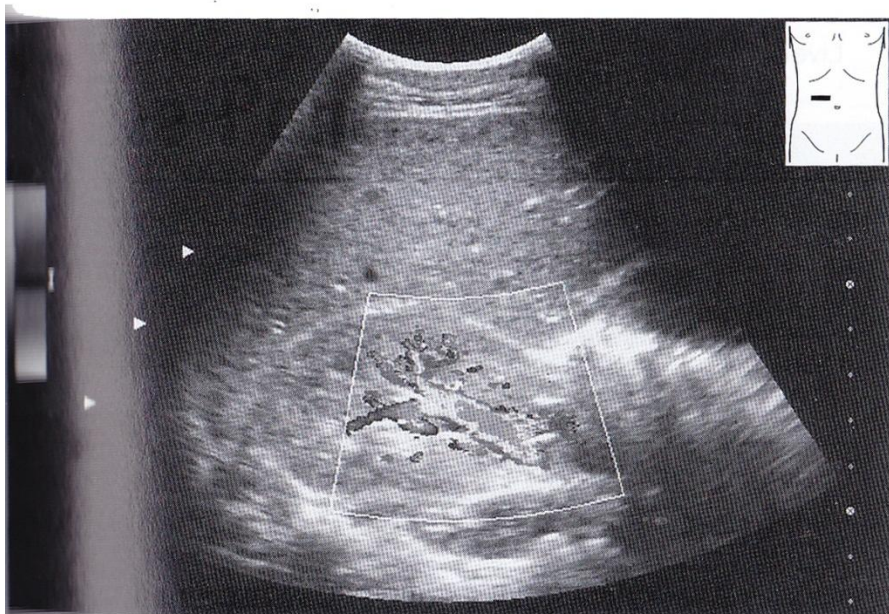


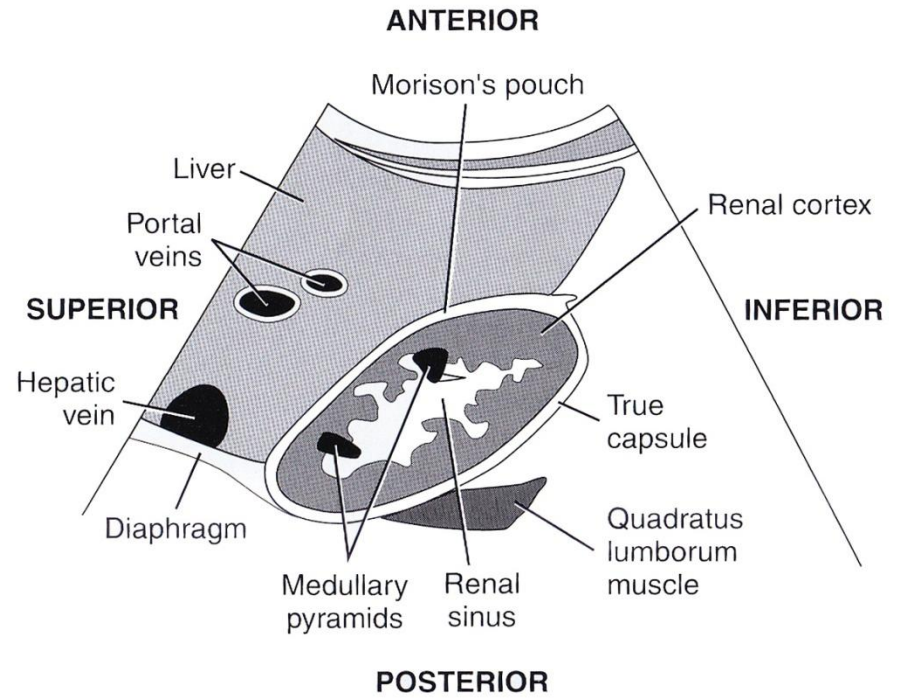


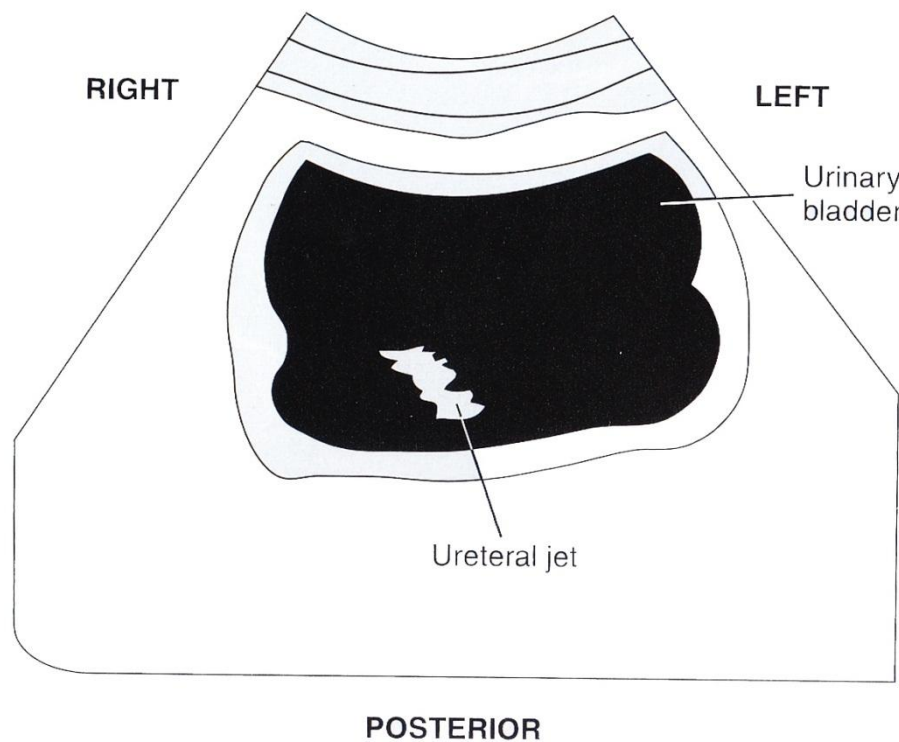
Renal column of Bertin  
Basic Ultrasound Training ( MPHA )

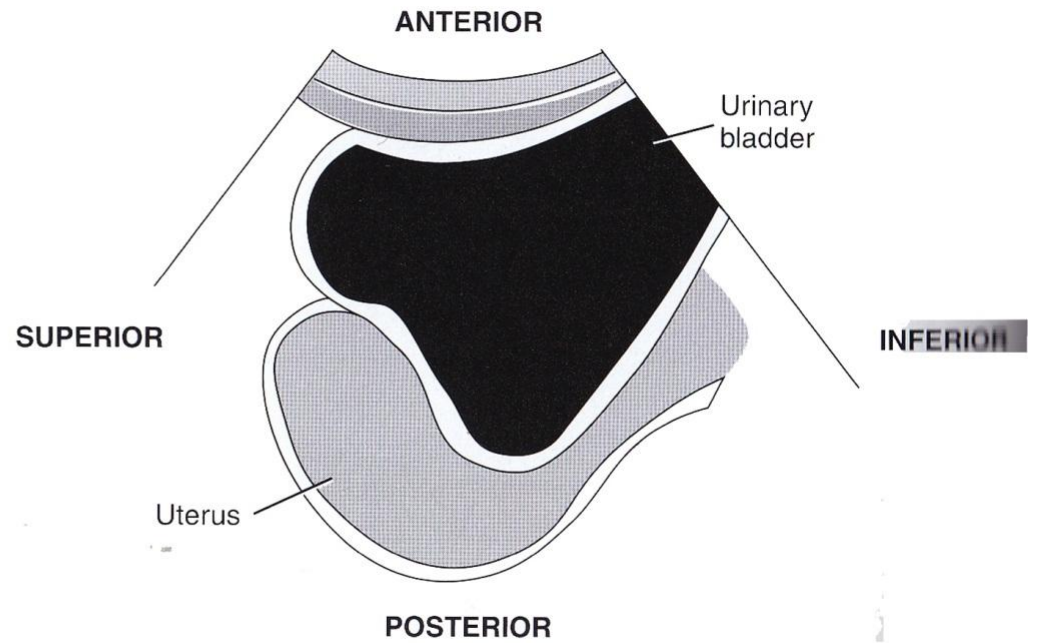




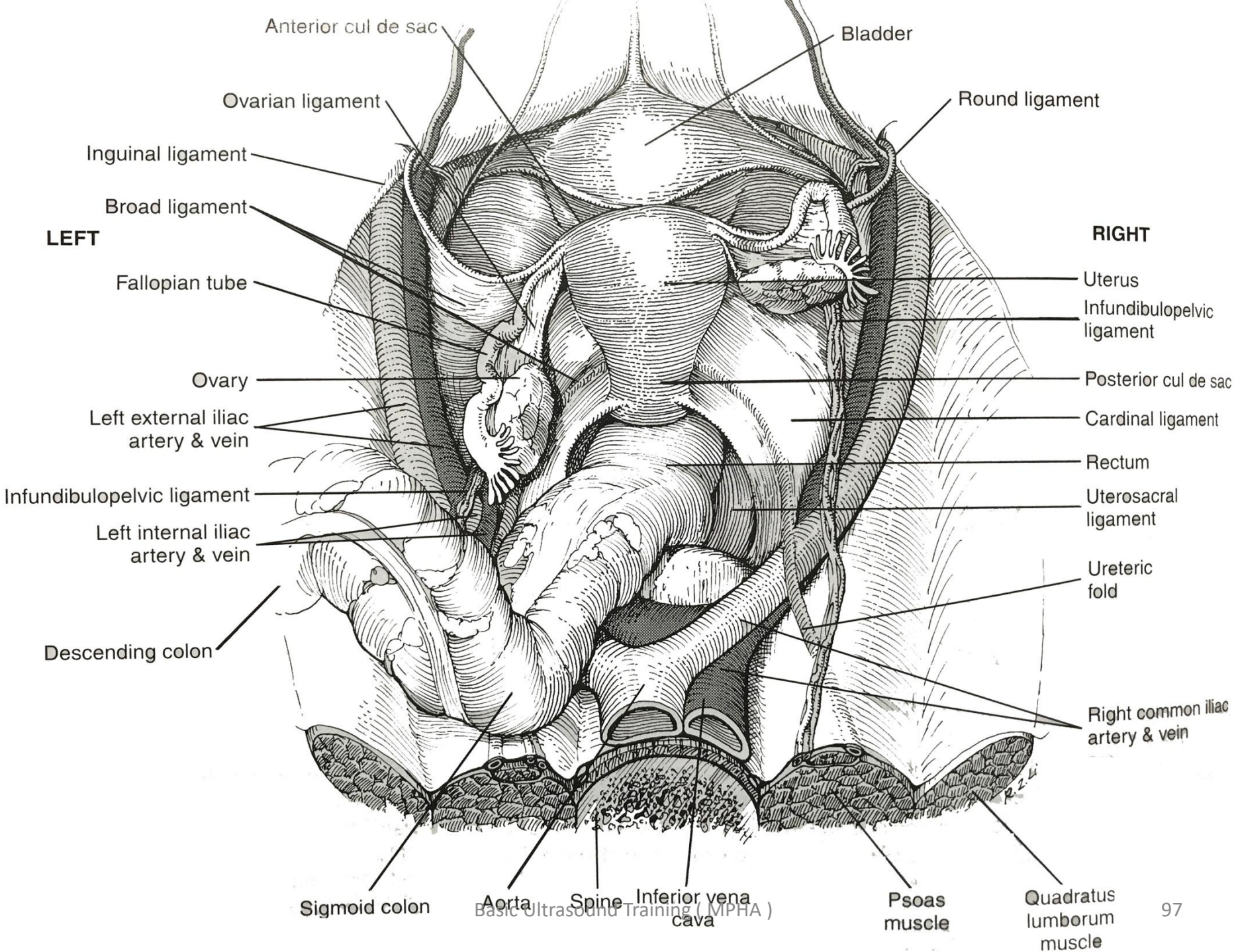


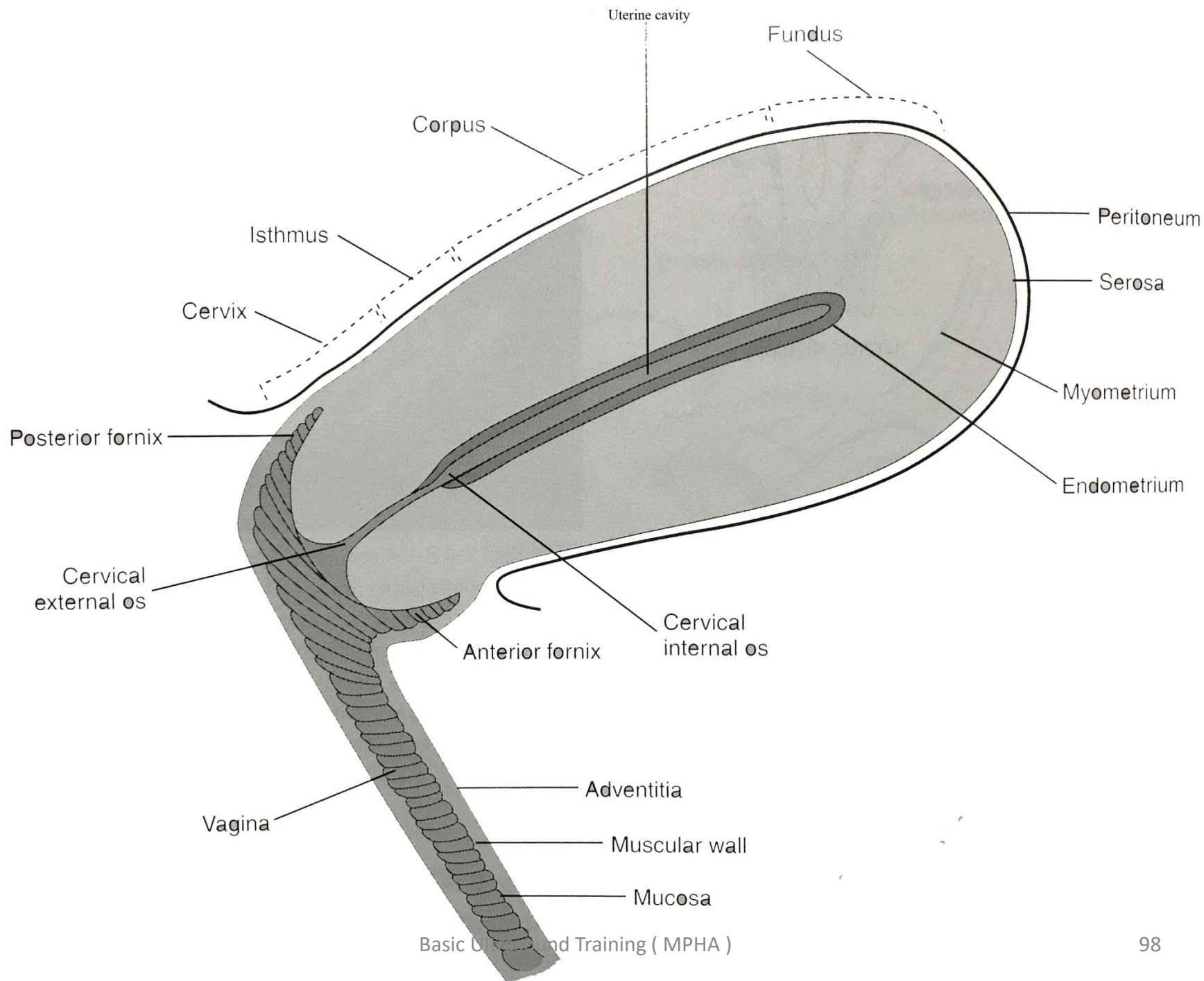


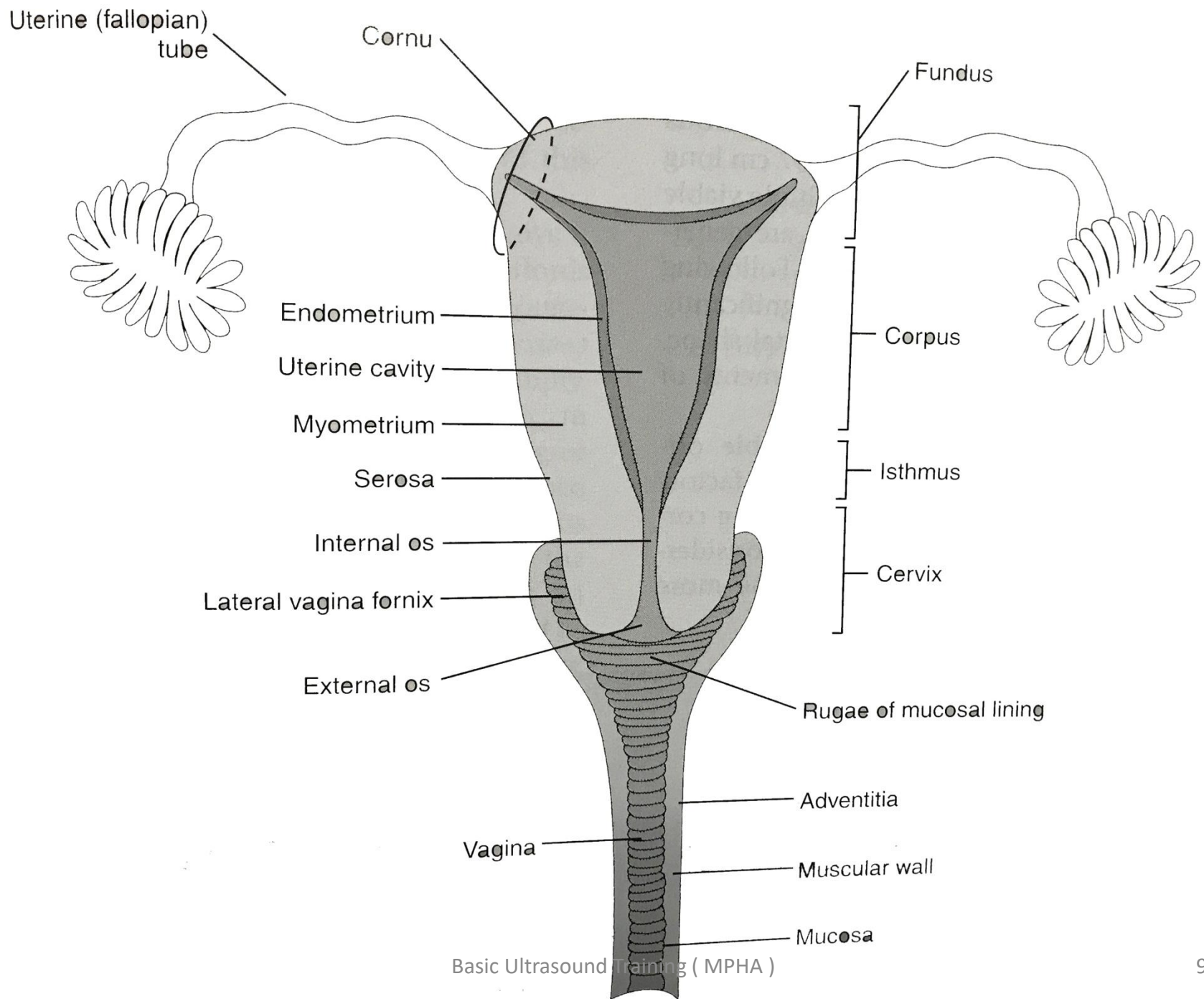


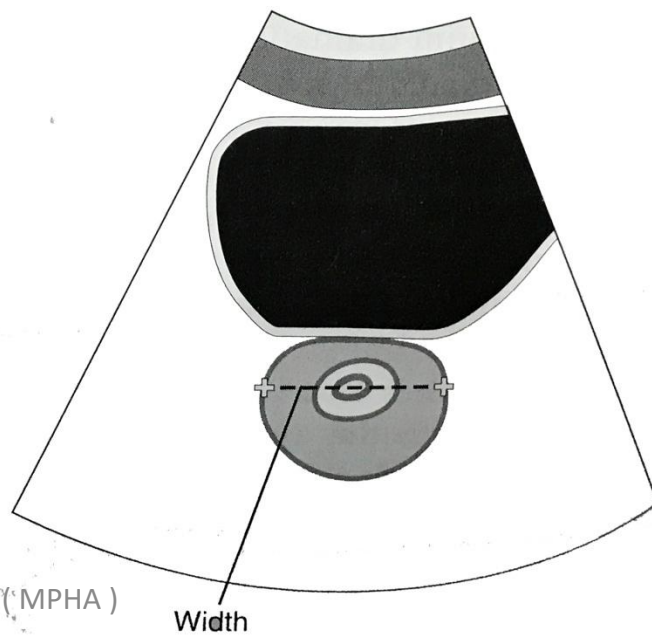
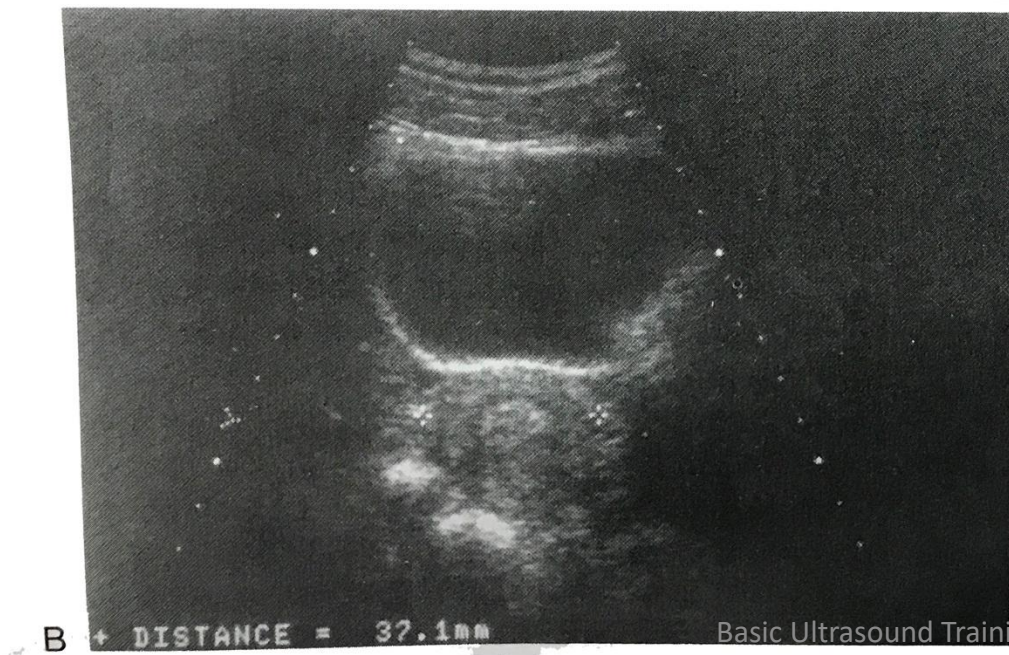
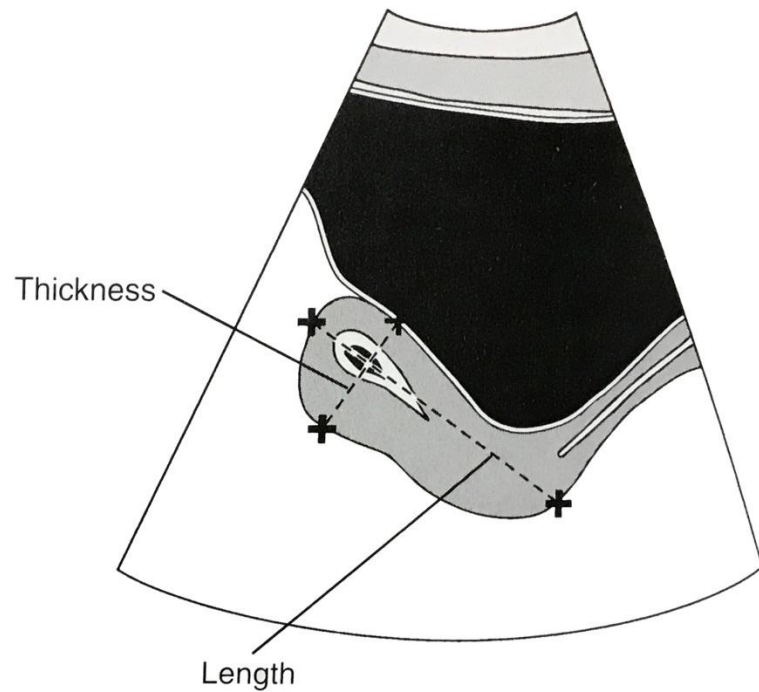
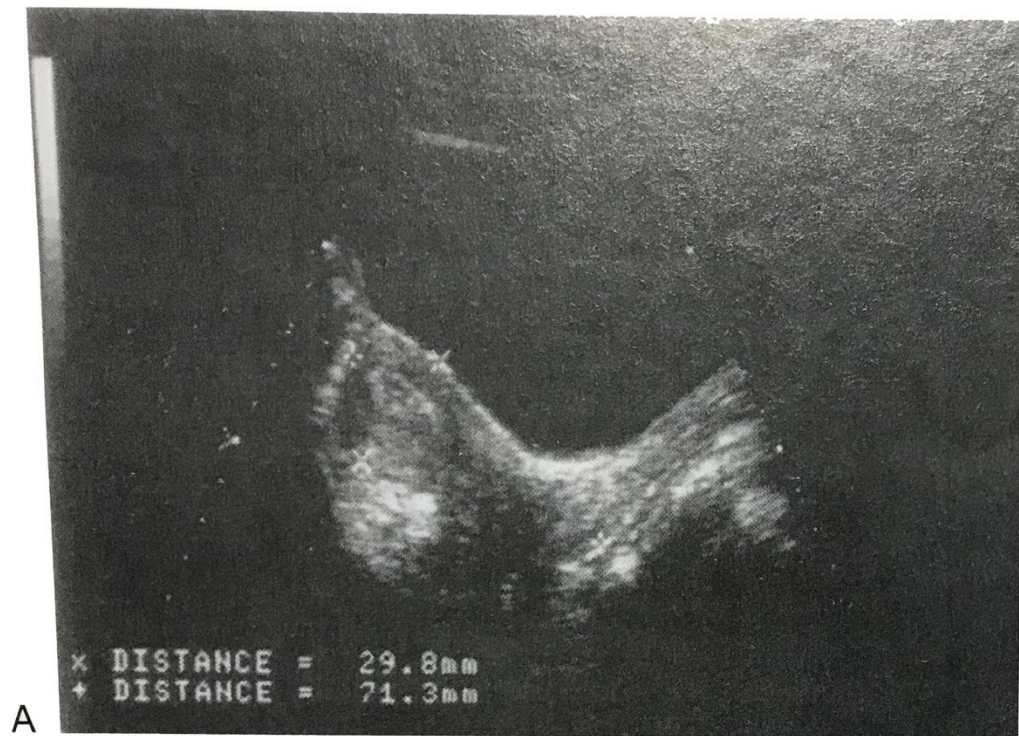


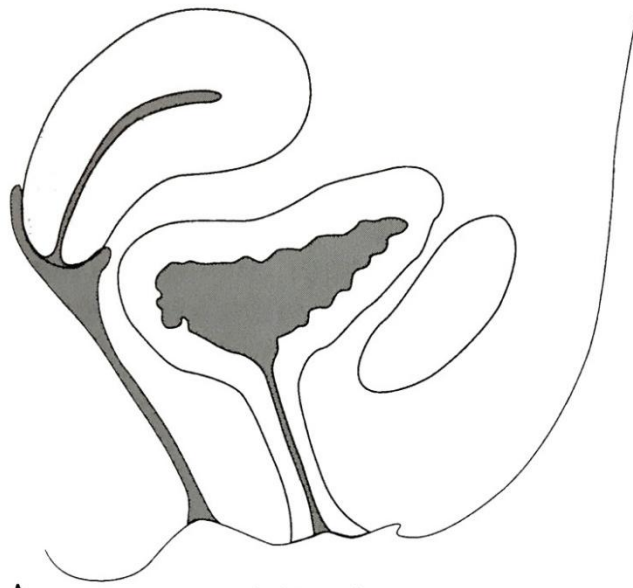
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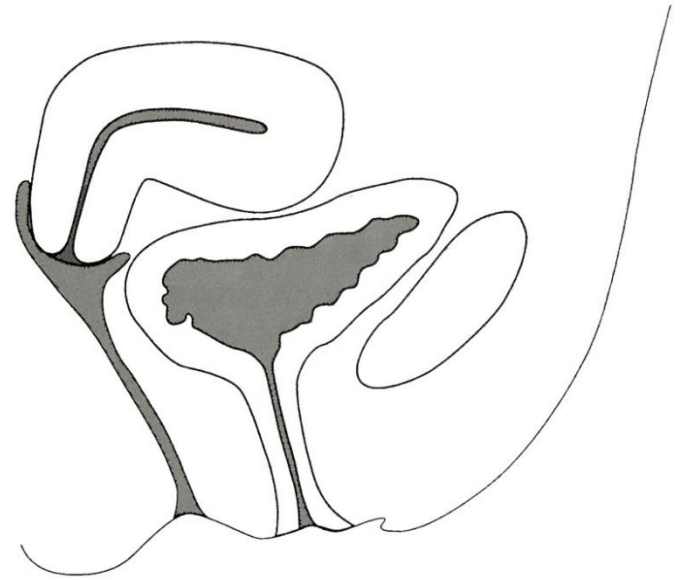






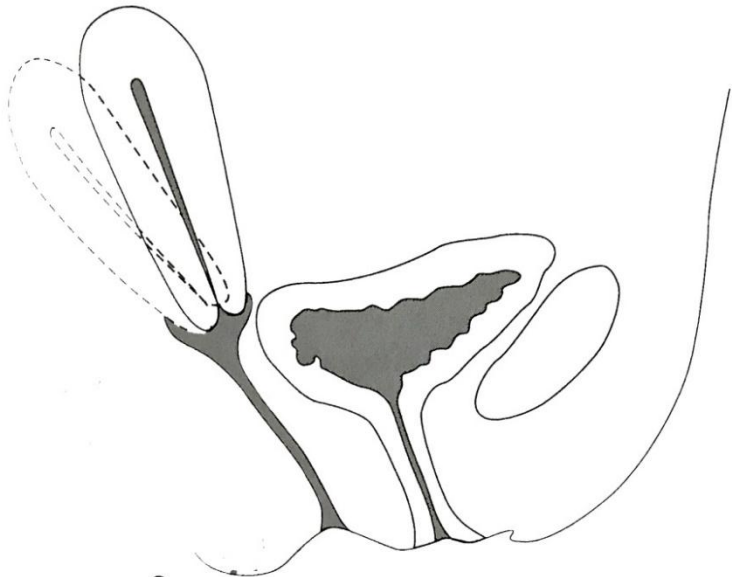
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Anteversion



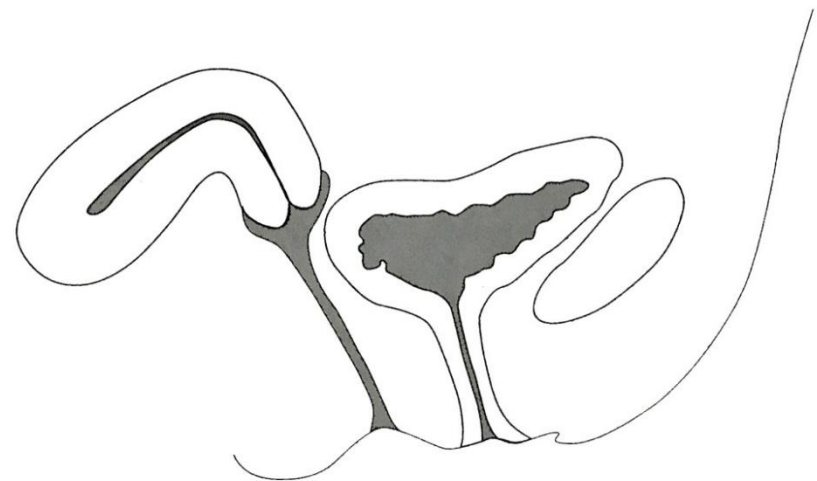
B

Antelexion



C

Retroversion



D

Retroflexion

# **Normal Values Assessment in Basic Ultrasound**

## **Arteries and Vein Measurement**

# 1. Normal Measurement of Abdominal Vessels

## (1) Average Diameter of Abdominal Arteries

Aorta	2.0 to 2.5mm
Celiac artery	0.70cm to 7mm
SMA	0.60cm
IMA	0.30cm
Renal arteries	0.40 to 0.50cm

## (2) Average Diameter of Abdominal Veins

IVC	25 to 35mm
Renal Veins	4.0 to 6.0mm
Hepatic Veins	4.0 to 7.0mm
SMV	6.0 to 7.0mm
Splenic Vein	4.0 to 6.0 mm
Portal vein	13mm
Common iliac veins	1.6 to 1.8cm diameter.
Right common iliac vein	5.5cm long
Left common iliac vein	7.5 long
Inferior vena cava	2.5cm diameter

## 2. Lower Extremity Arteries

Common iliac artery	1.20cm
External iliac artery	0.79cm
Common Femoral artery	0.082cm
Superficial femoral artery	0.60cm
Proximal portion	
Superfical femoral artery	0.54cm
Distal protion	
Popliteal artery	0.52cm
Tibial arteries	0.45cm

### Deep Veins

	Diameter
Tibial veins	5mm
Popliteal veins	0.9 to 1.5cm
Femoral veins (superficial femoral vein)	0.9 to 1.0cm
Common femoral vein	1.2 to 1.9 cm

### Supeficial Veins

	Diameter
Greater saphenous vein	2 to 3 mm (calf)
(thigh)	4 to 6mm
Lesser saphenous vein	4 to 7mm

### **3. NORMAL MEASUREMENT OF CEREBROVASCULAR VESSELS**

#### **EXTRACRANIAL CEREBROVASCULAR VESSELS**

#### **DIAMETER**

**COMMON CAROTID ARTERY**

**5 TO 6MM**

**INTERNAL CAROTID ARTERY/EXTERNAL PORTION**

**4. TO 5MM**

**EXTERNAL CAROTID ARTERY**

**3 TO 4MM**

**VETEBRAL ARTERIES**

**2 TO 3MM THEN SMALLER AS ARTERIES RUN**

**SUPERIORLY**

#### **INTRACRANIAL CEREBROVASCULAR ARTERIES**

#### **DIAMETER**

**INTERNAL CAROTID ARTERY/TERMINAL PORTION**

**3 TO 4MM**

**MIDDLE CEREBRAL ARTERY**

**2 TO 3MM**

**ANTERIOR CEREBRAL ARTERY**

**2.0 TO 2.5MM**

**ANTERIOR COMMUNICATING ARTERY**

**0.5 TO 1.0MM**

**POSTERIOR COMMUNICATING ARTERIES**

**1.5 TO 2.0MM**

**POSTERIOR CEREBRAL ARTERY**

**2.5 TO 3.0MM**

**BASILAR ARTERY**

**3.5 TO 4.2MM AND AT LEAST 2CM LONG**

**VERTEBRAL ARTERIES**

**2MM**

# ORGANS

## 1. MEASUREMENT OF LIVER

LIVER WEIGHT	ADULT MALES:	ADULT FEMALES:
	1400-1800G	1200-1400G
RIGHT LOBE	MIDCLAVICULAR LINEAR	13-17CM
	MEASUREMENT	
LEFT LOBE	HIGHLY VARIABLE	

## 2. MEASUREMENT OF GALL BLADDER AND BILE DUCT

GALLBLADDER	8-12CM LONG
	3-5CM DIAMETER
GALLBLADDER WALL	3MM THICK
RIGHT AND LEFT HEPATIC DUCTS	0.5-2.5 CM LONG (LEFT IS LONGER THAN RIGHT) 0.1-.2CM DIAMETER
COMMON HEPATIC DUCTS	2-6.5CM LONG
	0.1-.2CM DIAMETER
COMMON BILE DUCT	5-15CM LONG
	0.1-.7CM DIAMETER
CYSTIC DUCT	0.5-8CM LONG 0.1-4CM DIAMETER

### 3. NORMAL MEASUREMENT OF PANCREAS

TOTAL LENGTH OF PANCREAS	12.0-18CM
AP MEASUREMENT OF HEAD	2.0-3.0CM
AP MEASUREMENT OF NECK	1.5-2.5CM
AP MEASUREMENT OF BODY	2.0-3.0CM
AP MEASUREMENT OF TAIL	1.0-2.0CM

### 4. NORMAL MEASUREMENT OF KIDNEYS

STRUCTURE	LENGTH	DIAMETER	DEPTH(THICKNESS)
ADULT KIDNEY	9-11CM	4-6CM	2.5-4CM
NEONATAL KIDNEY	3.5-5CM	2-3CM	1.5-2.5CM
URETERS	28-34CM	6MM	NA
DISTENDED	NA	NA	3-6MM
URINARY BLADDER WALL			
FEMALE URETHRA	4CM	NA	NA
MALE URETHRA	20CM	NA	NA

## **5. NORMAL MEASUREMENT OF SPLEEN**

<b>SPLEEN LONG AXIS</b>	<b>12-13CM</b>
<b>SPLEEN DEPTH</b>	<b>7-8CM</b>
<b>SPLEEN WIDTH</b>	<b>6-7CM</b>
<b>SPLEEN VOLUME</b>	<b>60-200ML</b>
<b>SPLENIC INDEX</b>	<b>107-314CM<sup>3</sup></b>

## **6. NORMAL MEASUREMENT OF MALE GENITAL ORGAN**

**NORMAL ADULT TESTICLE : 3 TO 5CM IN LENGTH; 2 TO 3CM IN WIDTH; 2 TO 3CM ANTEROPOSTERIOR.**

**EPIDIDYMIS : 3.8CM IN LENGTH; UNCOILED, 6M**

**DUCTUS (VAS) DEFERENS : 45CM.**

**SEMINAL VESICLES : 5CM IN LENGTH, LESS THAN 1CM IN DIAMETER**

**PROSTATE VESICLES : 4CM WIDE, 3CM ANTEROPOSTERIOR 3.8CM IN LENGTH**

## 7. NORMAL MEASUREMENT OF FEMALE GENITAL ORGAN AND ACCESSORIES

	LENGTH	WIDTH	THICKNESS
VAGINAL CANAL	9CM		
CERVICAL CANAL	2-4CM		
PREMENARCHAL UTERUS	2.5CM	2CM	1CM
NULLIPAROUS UTERUS	7CM	4CM	3CM
MULTIPAROUS UTERUS	8.5CM	5.5CM	4.5CM
UTERINE TUBES	7-12CM		
ADULT OVARY	2.5-5CM	1.5-3CM	0.6-2.2CM

OVARIAN VOLUMES		MEAN (ML)
PREMENARCHE	(3-15 YEARS)	$3.0 \pm 2.3$
MENSTRUATING		$9.8 \pm 5.8$
PREMENOPAUSAL		6.8
POSTMENOPAUSAL	(1-5 YEARS AFTER)	$6.2 \pm 2.7$ TO $4.0 \pm 1.8$
POSTMENOPAUSAL	(10-15 YEARS AFTER)	$2.8 \pm 2.1$ TO $2.2 \pm 1.4$

## **A. 8. NORMAL MEASUREMENT OF PREGNANCY**

**MEAN SAC DIAMETER (MSD) : LENGTH + DEPTH + WIDTH ÷ 3**

**GESTATIONAL SAC:**

**A: VISIBLE WITH TRANSVAGINAL SONOGRAPHY WHEN MSD IS 2 TO 3MM, WHICH CORRESPONDS TO 4 WEEKS GA.**

**B. VISIBLE TRANSABDOMINALLY WHEN MSD IS 5MM, WHICH CORRESPONDS TO 5 WEEKS GA.**

**GESTATIONAL AGE (GA) IN DAYS:**

**A: MSD (IN MILLIMETERS ) +30 = GA (IN DAYS)**

**B: MSD OF 6MM CORRESPONDS TO 36 GESTATIONAL DAYS**

**CROWN – RUMP LENGTH (CRL)**

**A: LONG AXIS MEASUREMENT OF THE EMBRYO**

**B: CRL INCREASES BY APPROXIMATELY 1MM/DAY.**

**YOLK SAC:**

**MAXIMUM DIAMETER IS 5 TO 6 MM, WHICH CORRESPONDS TO A CRL OF 30 TO 45MM.**

## 9. NORMAL MEASUREMENT OF THYROID

ADULT THYROID GLAND	: 4-6CM IN LENGTH, 1.3- 1.8CM IN ANTEROPOSTERIOR DIAMETER,
1.5-2CM IN WIDTH.	
ISTHMUS (ADULT)	: 0.2-0.6CM IN ANTEROPOSTERIOR DIAMETER
THYROID GLAND IN NEWBORNS AND CHILDREN	: 2-3CM IN LENGTH, 0.2-1.2CM IN ANTEROPOSTERIOR DIAMETER
1-1.5CM IN WIDTH.	

## 10. NORMAL MEASUREMENT OF HEART

### (1) VENTRICULAR SIZE

VENTRICULAR DEPTH	: IN A CORONAL PLANE AT THE LEVEL OF THE FARAMEN OF MONRO, THE BODIES OF THE
LATERAL VENTRICLES ARE MEASURED FROM WALL TO WALL . THIS MEASUREMENTS IS THE WIDEST LINE PERPENDICULAR TO THE	
LONGEST AXIS OF THE VENTRICLES. NORMAL MEASUREMENT: 4MM OR LESS.	
MIDLINE TO LATERAL DIMENSION	: IN THE SAME CORONAL PLANE, THIS MEASUREMENT IS THE HORIZONTAL DISTANCE FROM
THE MID-LINE (I.E, FALX ) TO THE MOST LATERAL ASPECT OF THE LATERAL VENTRICLES.	
NORMAL MEASUREMENT	: 12MM OR LESS.

### (2) NORMAL M-MODE MEASUREMENTS

AORTIC ROOT DIMENSION	: 1.9 - 4.0CM
AORTIC CUSP SEPARATION	: 1.5 - 2.6CM
LEFT ATRIAL DIMENSION	: 1.9 - 4.0CM
MITRAL VALVE EXCURSION	: 1.6 - 3.0CM
MITRAL VALVE EF SLOPE	: 70 - 150MM/SEC
LEFT VENTRICULAR END DIASTOLIC DIMENSION	: 3.5 - 5.7CM
LEFT VENTRICULAR EJECTION FRACTION	: 0.55%
LEFT VENTRICULAR FRACTIONAL SHORTENING	: 0.25%
INTERVENTRICULAR SEPTAL THICKNESS	: 0.6 - 1.2CM
POSTERIOR LEFT VENTRICULAR WALL THICKNESS	: 0.6 - 1.2CM
RIGHT VENTRICULAR DIMENSION	: 0.7 - 2.7CM

# **Most Commonly Seen Abbreviation**

# APPENDIX 1.

## Most Commonly Seen Abbreviations on Requisitions

PATRICIA MAY KAPLAN

AAA	Abdominal aortic aneurysm	EDC	Estimated date of confinement	LK	Left kidney
Ab	Abortion	EFW	Estimated fetal weight	LLQ	Left lower quadrant
AFM	After fatty meal	ETOH'er	Ethanol (alcohol) abuser	LOLINAD	Little old lady in no apparent distress
AFP	Alpha fetoprotein	EUA	Examination under anesthesia	LPO	Left posterior oblique
ALL	Acute leukocytic leukemia	F	Fahrenheit	LSO	Left salpingo-oophorectomy
AML	Acute monocytic leukemia	FCD	Fibrocystic disease	LSU	Left side up
A-Mode	Amplitude modulation	FDIU	Fetal death in utero	LT	Ligamentum teres
AODM	Adult onset of diabetes mellitus	FH	Fundal height, Fetal heart, or Family history	LUQ	Left upper quadrant
AROM	Artificial rupture of membranes	FSH	Follicle-stimulating hormone	MHz	Megahertz
ATB	Antibiotic	FUO	Fever of unknown origin	MIF	Medium internal focus (transducer)
ATN	Acute tubular necrosis	FTT	Failure to thrive	ML	Midline
BE	Barium enema	G	Gravida	mm	Millimeter
B-H	Braxton-Hicks' contraction	GB	Gallbladder	M-Mode	Time motion modulation
BIP (BPD)	Biparietal diameter	GI	Gastrointestinal	N	Notch (sternal)
B-Mode	Brightness modulation	GTD	Gestational trophoblastic disease	NEFG	Normal external female genitalia
BMT	Bone marrow transplant	GU	Genitourinary	NGT	Nasogastric tube
BP	Blood pressure	GVHD	Graft versus host disease	NPO	Nothing by mouth
BPD (BIP)	Biparietal diameter	Gyn	Gynecology	NSS	Normal size and shape
BPH	Benign prostatic hypertrophy	HBP	High blood pressure	NST	Nonstress test
BSO	Bilateral salpingo-oophorectomy	HC	Hepatocellular, or Head circumference	NSVD	Normal spontaneous vaginal delivery
BTD	Biliary tract disease	HCG	Human chorionic gonadotropin	Ob	Obstetrics
BUN	Blood urea nitrogen	HCT	Hematocrit	OCT	Oxytocin challenge test
Bx	Biopsy	HSM	Hepatosplenomegaly	OCG	Oral cholecystogram
C	Celsius (centigrade)	Hydro	Hydrocephalus, or Hydronephrosis	OR	Operating room
c	With	IC	Iliac crest	p	After
CBD	Common bile duct	IDDM	Insulin-dependent diabetes mellitus	PA	Popliteal artery, or Popliteal aneurysm
CEC	Central echo complex	IUCD (IUD)	Intrauterine contraceptive device	Para 1234	(1) Number of full-term pregnancies, (2) number of premature births, (3) number of abortions, (4) number of living children
CHD	Common hepatic duct	IUGR	Intrauterine growth retardation	PE	Pleural effusion, or Pulmonary embolus
cm	Centimeter	IUP	Intrauterine pregnancy	PID	Pelvic inflammatory disease
CML	Chronic myeloid leukemia	IVC	Inferior vena cava	POD#	Post-op day (# ___)
CNS	Central nervous system	IVP	Intravenous pyelogram	PP	Postpartum
Cr	Creatinine	JODM	Juvenile onset diabetes mellitus	PPD	Test for tuberculosis
CRT	Cathode ray tube	K	Potassium	PROM	Premature rupture of membranes
C/S	Cesarean section	LE	Lower extremity	PSI	Postsaline injection
CST	Contraction stress test	LFT	Liver function test (e.g., SGPT, SGOT, alk phos)	PT	Pregnancy test
Cx	Cervix	LH	Luteinizing hormone	PTA	Prior to admission
db	Decibel	LIF	Long internal focus	PTT	Prothrombin time
D & C	Dilatation and curettage	LIF	Long internal focus	PUD	Peptic ulcer disease
D = E	Dates equal exam			PV	Portal vein
D = E = S	Dates equal exam equal sonogram				
D ≠ E	Dates do not equal exam				
D < E	Small for dates				
D > E	Large for dates				
DFHT	Documented fetal heart tone				
D.T.'s	Delirium tremens				
DTR	Deep tendon reflex				
Dx	Diagnosis				

RBC Red blood cell  
 RCM Right costal margin  
 RK Right kidney  
 RLL Right lower lobe  
 RLQ Right lower quadrant  
 R/O Rule out  
 ROM Rupture of membranes  
 RPO Right posterior oblique  
 RSO Right  
 salpingo-oophorectomy  
 RT Real-time (dynamic  
 imaging)  
 RUQ Right upper quadrant  
 Rx Treatment  
 S Symphysis pubis (SP or P)  
 s Without

SBE Subacute bacterial  
 endocarditis  
 SIF Short internal focus  
 (transducer)  
 SMA Superior mesenteric artery  
 SMV Superior mesenteric vein  
 SVD Spontaneous vaginal  
 delivery  
 TAB Therapeutic abortion  
 TAH Total abdominal  
 hysterectomy  
 TC Trunk circumference  
 TCG Time compensation gain  
 TGC Time gain compensation  
 TIUV Total intrauterine volume  
 TOA Tubo-ovarian abscess

TURP Transurethral resection of  
 prostate  
 TVH Total vaginal hysterectomy  
 Tx Transplant  
 U Umbilicus  
 UE Upper extremity  
 UGI Upper gastrointestinal  
 series  
 UPJ Ureteropelvic junction  
 US Ultrasound  
 UTI Urinary tract infection  
 UVJ Ureterovesical junction  
 VTX vertex presentation  
 WBC White blood cell  
 X Xyphoid

## APPENDIX 2.