Role of Ultrasound and MRI in Assessment of Fetal GIT and Anterior Abdominal Wall Anomalies

Thesis

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بسم الله الرحمن الرحيم

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وَنُسُكِي

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للهِ رَبِّ الْعَالَمِينَ

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✍ *Somaia Abdelrahman Sulaiman*

List of Contents

Title	Page No.

List of Contents .... *i*

List of Tables.. *ii*

List of Figures .... *iii*

Introduction.. *- 1 -*

Aim of work .... *- 2 -*

Review of Literature

Chapter(1): Emberiology of The Gastrointestinal Tract.. *- 3 -*

Chapter(2): Sonography of The Normal Fetal Gastrointestinal Tract And Anterior Abdominal Wall......................... *- 18 -*

Chapter(3): Technique and Normal MRI......... *- 29 -*

Chapter(4): Ultrasound In Scanning GIT And Abdominal Wall Anomalies.......... *- 47 -*

Chapter(5): MRI In Anomaly Scan................. *- 80 -*

Summary .... *- 96 -*

Conclusion ....*- 100 -*

References..*- 101 -*

Arabic summary.. --

List of Tables

Table No.	Title	Page No.
Table (1):	Parameters of fetal MRI sequences	- 36 -
Table (2):	Fetal Abdominal Cysts by Organ Systems.	- 63 -
Table (3):	Characteristics of omphalocele and gastrochisis	- 75 -

List of Figures

Fig. No.	Title	Page No.
Figure (1):	Formation of the foregut, midgut, and hindgut.	- 3 -
Figure (2):	Development of primitive gut.	- 4 -
Figure (3):	Development of esophagus.	- 5 -
Figure (4):	Rotation of the stomach	-6-
Figure (5):	Formation of the liver bud	- 7 -
Figure (6):	Development during approximately 36 days	- 8 -
Figure (7):	Derivation of various parts of pancreas.	- 9 -
Figure (8):	Development of pancreas and its ducts.	- 9 -
Figure (9):	Development of duodenum.	- 10 -
Figure (10):	Duodenal loop formation.	- 11 -
Figure (11):	Embryo during the sixth week of development.	- 11 -
Figure (12):	Rotation and herniation of the small intestine.	- 12 -
Figure (13):	A:Intestinal rotation.	- 13 -
Figure (14):	Successive stages in development of the cecum and appendix	- 14 -
Figure (15):	Cloacal region in embryos at successive stages of development.	- 16 -
Figure (16):	Sagittal view of the mesenteries of the gut	- 17 -
Figure (17):	The optimal position of the patient on the examination table	- 20 -
Figure (18):	The optimal position of the patient for transvaginal ultrasound	- 20 -
Figure (19):	The optimal position of the patient and doctor on the examination ..	- 21 -
Figure (20):	Cranial views for the assessment of the upper gastrointestinal tract	- 21 -
Figure (21):	Ultrasound views of the thoracic esophagus.	- 22 -
Figure (22):	Axial abdominal views (stomach, bowel, liver, and spleen).	- 23 -
Figure (23):	Other abdominal views (liver, abdominal wall, and rectum) .	- 24 -
Figure (24):	Tubular echogenic appearance of the esophagus.	- 25 -
Figure (25):	Axial view of the upper abdomen	- 25 -
Figure (26):	Axial view of the upper abdomen in a 35-week-old fetus	- 26 -
Figure (27):	fetal spleen at 14 weeks of gestation	- 27 -
Figure (28):	Pulsed wave Doppler of the umlical artery	- 28 -
Figure (29):	Umbilical Cord Insertion.	- 28 -
Figure (30):	Photograph of the open MRI scanner	- 35 -
Figure (31):	Prenatal MRI evaluates the fetus and pregnancy structures.	- 36 -
Figure (32):	Visualization of the esophageal pouch	- 37 -
Figure (33):	Oblique sagittal T2-weighted image of a fetus with microgastria at 24 weeks gestational age.	- 38 -
Figure (34):	Varying appearance of normal fetal abdomen at different gestational ages	- 39 -

List of Figures *(Com)*

Fig. No.	Title	Page No.

Figure (35): MRI of a normal fetal abdomen. .... - 40 -
Figure (36): Normal liver. T2-weighted images. .... - 41 -
Figure (37): Axial T2-weighted images of the fetal spleen and liver .... - 42 -
Figure (38): Sagittal T2 weighted images depicting the fetal spleen .... - 43 -
Figure (39): Sagittal echoplanar images demonstrate signal changes of the fetal spleen and liver .... - 43 -
Figure (40): Normal fetal bowel at 24 weeks of gestation .... - 44 -
Figure (41): Frontal T1 weighted image of the fetal colon .... - 45 -
Figure (42): MRI of the umbilical cord .... - 46 -
Figure (43): Variations of tracheoesophageal anomalies .... - 47 -
Figure (44): Sonogram of esophageal atresia. .... - 50 -
Figure (45): Sonogram ofTracheoesophageal atresia with tracheoesophageal fistula .... - 50 -
Figure (46): Types of duodenal atresias. .... - 51 -
Figure (47): Sonogram of Duodenal atresia . ... - 53 -
Figure (48): Types of intestinal atresias .... - 54 -
Figure (49): Transverse view of the fetal abdomen in a fetus with distal ileal atresia. .... - 56 -
Figure (50): Axial ultrasound of ileal atresia .... - 57 -
Figure (51):A transverse scan of the abdomen in a 19 week fetus demonistrating intense echogenicity of the small bowel .... - 58 -
Figure (52): Sonogram of dilated bowel at a 23 week fetus. .... - 61 -
Figure (53): Sonogram of fetus with anal atresia and rectovesical fistula .... - 62 -
Figure (54): Sonogram of anorectal atresia. .... - 62 -
Figure (55): Scheme for differential diagnosis of abdominal cysts .... - 64 -
Figure (56): Presence of intraluminal calcifications in the fetal abdomen. .... - 64 -
Figure (57): Hepatomegaly .... - 66 -
Figure (58): Severe hepatomegaly due to CMV infection. .... - 67 -
Figure (59): Splenomegaly .... - 68 -
Figure (60): A large cystic mass in the liver. .... - 69 -
Figure (61): Iatrogenic Meconium Peritonitis .... - 70 -
Figure (62): Meconium Pseudocyst with bowel Atresia (ileal) .... - 71 -
Figure (63): Typical appearance of gastroschisis and omphalocele. .... - 75 -
Figure (64): Gastrochisis in a third trimester fetus .... - 76 -
Figure (65): Gastroschisis at 16 weeks of gestation.. .... - 76 -
Figure (66): Gastroschisis at 31 weeks of gestation .... - 77 -
Figure (67): Omphalocele .... - 77 -

List of Figures (Com)

Fig. No.	Title	Page No.

Figure (68): (a) Longitudinal view of the abdomen with omphalocele. .... - 78 -
Figure (69): 3D ultrasound of a large omphalocele .... - 78 -
Figure (70): Cloacal extrophy . ... - 79 -
Figure (71): postnatal assessment radiograph of cloacal extrophy .... - 79 -
Figure (72): Visualization of the esophageal pouch by MRI .... - 80 -
Figure (73):MRI of esophageal atresia. .... - 81 -
Figure (74):MRI of duodenal atresia .... - 82 -
Figure (75):MRI of jejunal atresia .... - 84 -
Figure (76): Fetus at 23+5 GW with jejunal atresia. .... - 86 -
Figure (77: Intraluminal calcifications .... - 87 -
Figure (78): Diaphragmatic hernia . ... - 88 -
Figure (79): Sagittal T2 weightd image a fetus at 29+5 GW with Omphalocele with extracorporeal liver .... - 89 -
Figure (80): Frontal images of a fetus at 21+1 GW with hepatospleenomegaly. .. - 90 -
Figure (81): Sagittal T2 wheighted image of afetus at 26+3GW with septated splenic cyst .... - 90 -
Figure (82): Omphalocele in a fetus at 29+5 GW with extracorporeal liver. .... - 91 -
Figure (83): Large anterior abdominal wall defect .... - 92 -
Figure (84): Gastroschisis .... - 93 -
Figure (85): Fetal MRI in a normal rectum after 20–21 weeks' GA .... - 94 -
Figure (86): VACTERL association. .... - 94 -
Figure (87): Fetal MRI of bladder diverticulum .... - 95 -
Figure (88): postnatal cloacagram .... - 95 -

Introduction

Abnormalities involving the gastrointestinal tract and abdominal wall anomalies account for about 15% of all the congenital abnormalities that are identifiable by ultrasound in antenatal period. Anomalies detected includes : Esophageal Atresia and Tracheo-esophageal fistula , Duodenal Atresia, Small Bowel Atresia, Meconium Ileus, Anorectal Anomalies, Hepatomegaly/ Splenomegaly and other liver lesions, Ascites, Abdominal Cysts, Retroperitoneal masses, Omphalocele, Gastroschisis, Bladder Extrophy***. (AbdElkhaek 2012)***

Ultrasonography (US) is the primary imaging modality for the evaluation of the fetus. It is safe for both fetus and mother, relatively inexpensive, allows real-time imaging, and is readily available***.(Behairy et al., 2010).***

Although ultrasound (US) remains the predominant modality for evaluating disorders related to pregnancy, fetal MRI has been increasingly used. In contradistinction to US, MRI visualization of the fetus is not significantly limited by maternal obesity, fetal position, or oligohydramnios and visualization of the brain is not restricted by the ossified skull. Through its superior soft tissue contrast resolution, MRI is able to distinguish individual fetal structures such as lung, liver, kidney, and bowel. Moreover, MRI provides multiplanar imaging as well a large field of view, facilitating examination of fetuses with large or complex anomalies, and visualization of the lesion within the context of the entire fetal body***.(Saleem S N 2014).***

Aim of work

The aim of work is to illustrate the importance and diagnostic value of Ultrasound and MRI in scanning and detection of fetal GIT and Abdominal wall anomalies.

Displaying the advantages and limitations of each modality and their outcome.

Chapter (1):

Emberiology of The Gastrointestinal Tract

The digestive tract (gastrointestinal tract) develops from primitive gut that is derived from the dorsal part of endodermal yolk sac.***(Singh et al., 2012).***As a result of cephalocaudal and lateral folding of the embryo, a portion of the endoderm-lined yolk sac cavity is incorporated into the embryo to form the primitive gut. Two other portions of the endoderm-lined cavity, the yolk sac and the allantois, remain outside the embryo (Fig.1 a–d). In the cephalic and caudal parts of the embryo, the primitive gut forms a blind-ending tube, the foregut and hindgut, respectively. The middle part, the midgut, remains temporally connected to the yolk sac by means of the vitelline duct, or yolk stalk (Fig1d).***(Sadler 2012).***

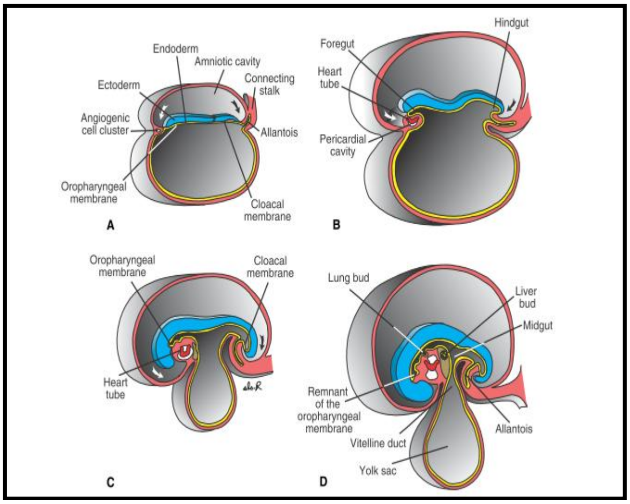

Figure (1): Sagittal sections through embryos at various stages of development demonstrating the effect of cephalocaudal and lateral folding on the position of the endoderm-lined cavity. Note formation of the foregut, midgut, and hindgut. A. Pre somite embryo. B. Embryo with seven somites. C. Embryo with 14 somites. D. At the end of the1rst month.(Sadler 2012).

The oral cavity (mouth) is formed following breakdown of the buccopharyngeal membrane (oropharyngeal or oral membrane) and contributed to mainly by the pharynx lying within the pharyngeal arches. Loss of buccopharyngeal membrane opens the tract to amniotic fluid through the remainder of development, and during the fetal period is actively swallowed.***(Hill 2016).***

The foregut will develop into the pharynx, oesophagus, stomach and the first two parts of the duodenum to the major duodenal papilla, at which the common bile duct and pancreatic duct enter. The midgut includes the remainder of the duodenum and the small and large intestine through to the proximal two-thirds of the transverse colon. The hindgut includes the distal third of the transverse colon and the large intestine through to the upper part of the anal canal.***(de Wreedo and Webster 2012).***

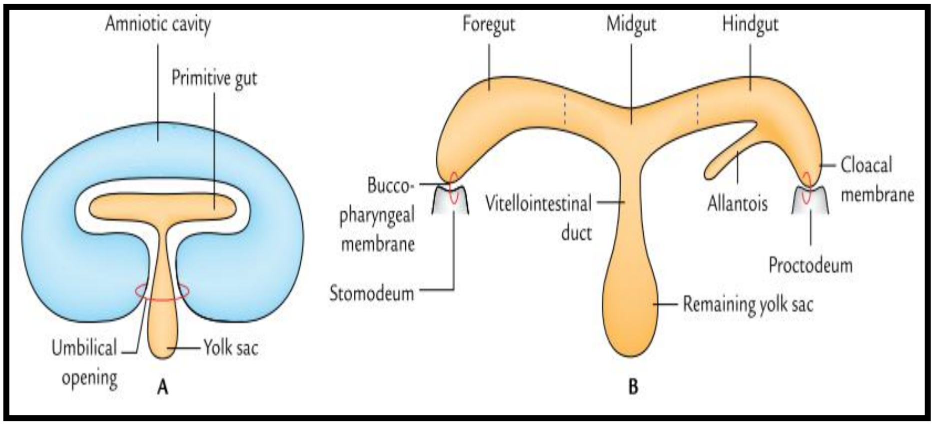

Figure (2): Development of primitive gut. A. The larger portion of yolk sac is taken inside the embryonic disc during its folding. Note that amniotic cavity covers the embryonic disc on all side except at the umbilical opening. B. Subdivisions of primitive gut into foregut, midgut, and hindgut. Note midgut communicates with the remaining yolk sac via vitellointestinal duct.(Singh 2012).

Derivatives of the foregut:

THE Esophagus:

The esophagus develops from the part of foregut between the pharynx and the stomach. Ventrally at the pharyngoesophageal junction, the foregut presents a median laryngotracheal groove. The groove bulges forward and caudally to form tracheobronchial (respiratory) diverticulum. The tracheoesophageal septum divides the foregut caudal to the pharynx into the esophagus and trachea (Fig3) . Initially the esophagus is short but later it elongates due to:

1. Formation of neck,
2. Descent of diaphragm, and
3. Descent of heart and lungs ***(Singh 2012).***

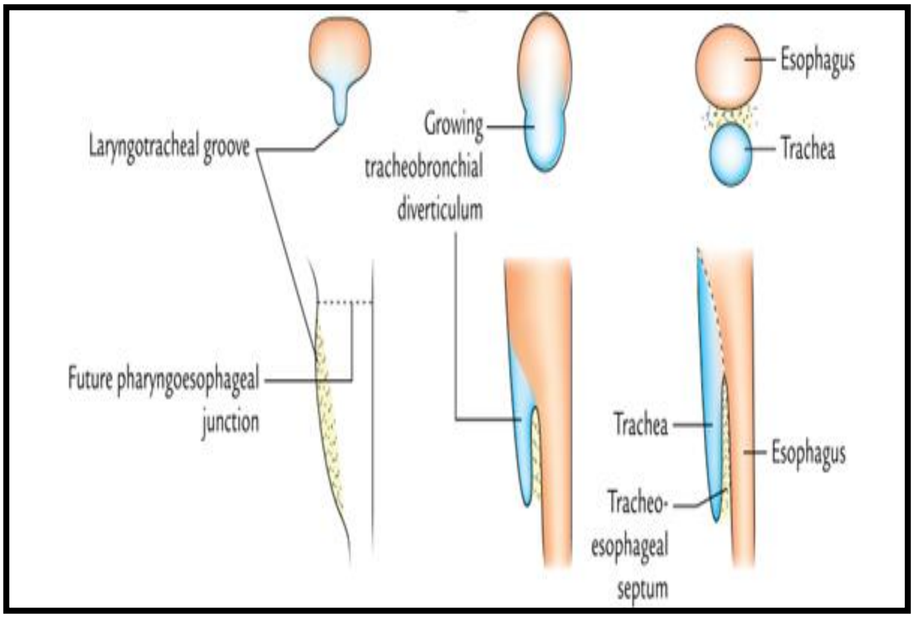

Figure (3): Development of esophagus. (Singh 2012).

The Stomach:

Appears first as a fusiform dilation of the foregut endoderm which undergoes a 90° rotation such that the left side moves ventrally and the right side moves dorsally (the vagus nerves follow this rotation which is how the left vagus becomes anterior and the right vagus becomes posterior),differential growth on the left and right sides establishes the greater and lesser curvatures, respectively; cranio-caudal rotation tips the pylorus superiorly dorsal and ventral mesenteries of the stomach are retained to become the greater and lesser omenta, respectively, proliferation of mesoderm-derived smooth muscle in the caudal end of the stomach forms the pyloric sphincter(dependent on a variety of genetic factors) ***.(Hill 2016) .***

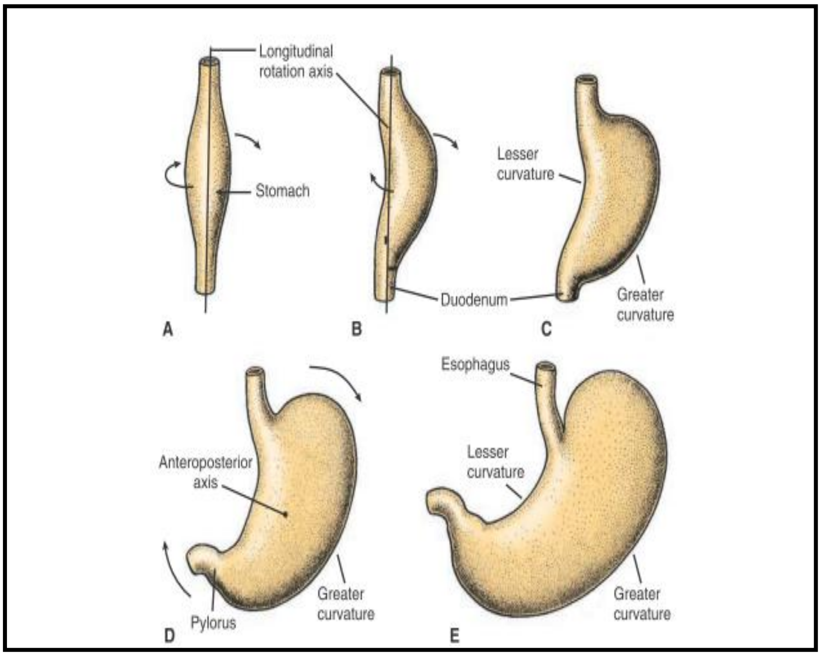

Figure (4): A–C. Rotation of the stomach along its longitudinal axis as seen anteriorly. D,E. Rotation of the stomach around the anteroposterior axis. Note the change in position of the pylorus and cardia.(Sadler 2012).

Liver and gallbladder:

The liver primordium appears in the middle of the third week as an outgrowth of the endodermal epithelium at the distal end of the forgut. This outgrowth, the hepatic diverticulum, or liver bud, consists of rapidly proliferating cells that penetrate the septum transversum, that is, the mesodermal plate between the pericardial cavity and the stalk of the yolk sac (Figs. 5 & 6). While hepatic cells continue to penetrate the septum, the connection between the hepatic diverticulum and the foregut (duodenum) narrows, forming the bile duct. A small ventral outgrowth is formed by the bile duct, and this outgrowth gives rise to the gallbladder and the cystic duct. (***Sadler 2012***).

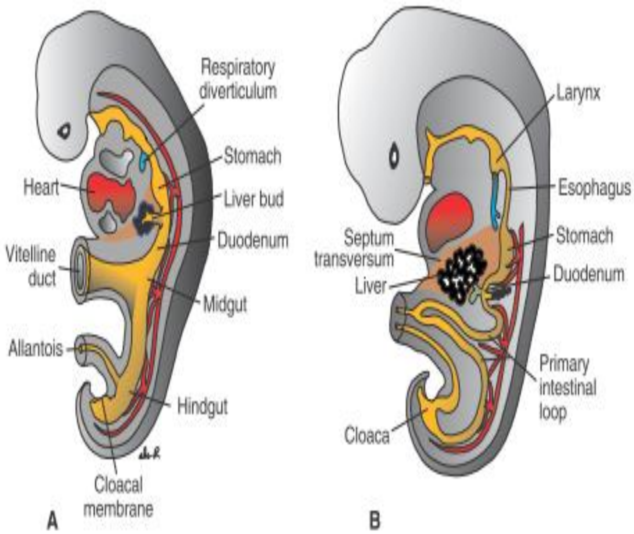

Figure (5): A. A 3-mm embryo (approximately 25 days) showing the primitive gastrointestinal tract and formation of the liver bud. The bud is formed by endoderm lining the foregut. B. A 5mm embryo (approximately 32 days). Epithelial liver cords penetrate the mesenchyme of the septum transversum.(Sadler 2012).