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FACTA ANATOMICA

Anterior abdominal wall defects

In humans, the incidence of congenital defects of the intraembryonic celom and its associated structures has increased over recent decades. Surgical treatment of abdominal and diaphragmatic malformations resulting in congenital hernia requires deep knowledge of ventral body closure and the separation of the primary body cavities during embryogenesis. The correct development of both structures requires the coordinated and fine-tuned synergy of different anlagen, including a set of molecules governing those processes.

Why less is known about development of human body wall

- Ethical issues to learn from human model so most of our knowledge derives from animal models.
- Different time frame of maturation and development in mice and human.
- Mouse genome 14% smaller than humans.

What is needed?

To understand the consequences of extrinsic and intrinsic interrupters for differentiating organ systems.

To understand the temporal, spatial, and morphogenetic sequence of organogenesis

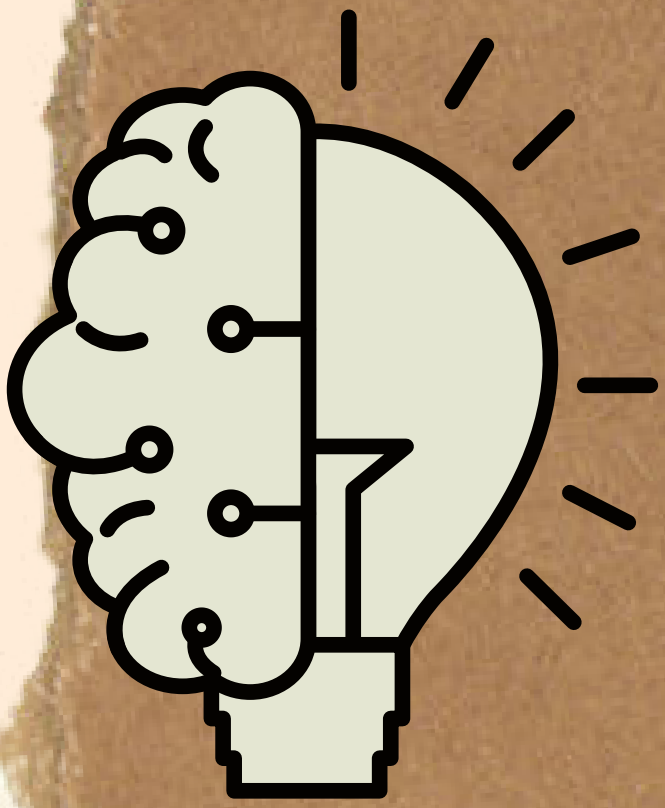
New doors to understand Human organogenesis

1) Genomic hybridization

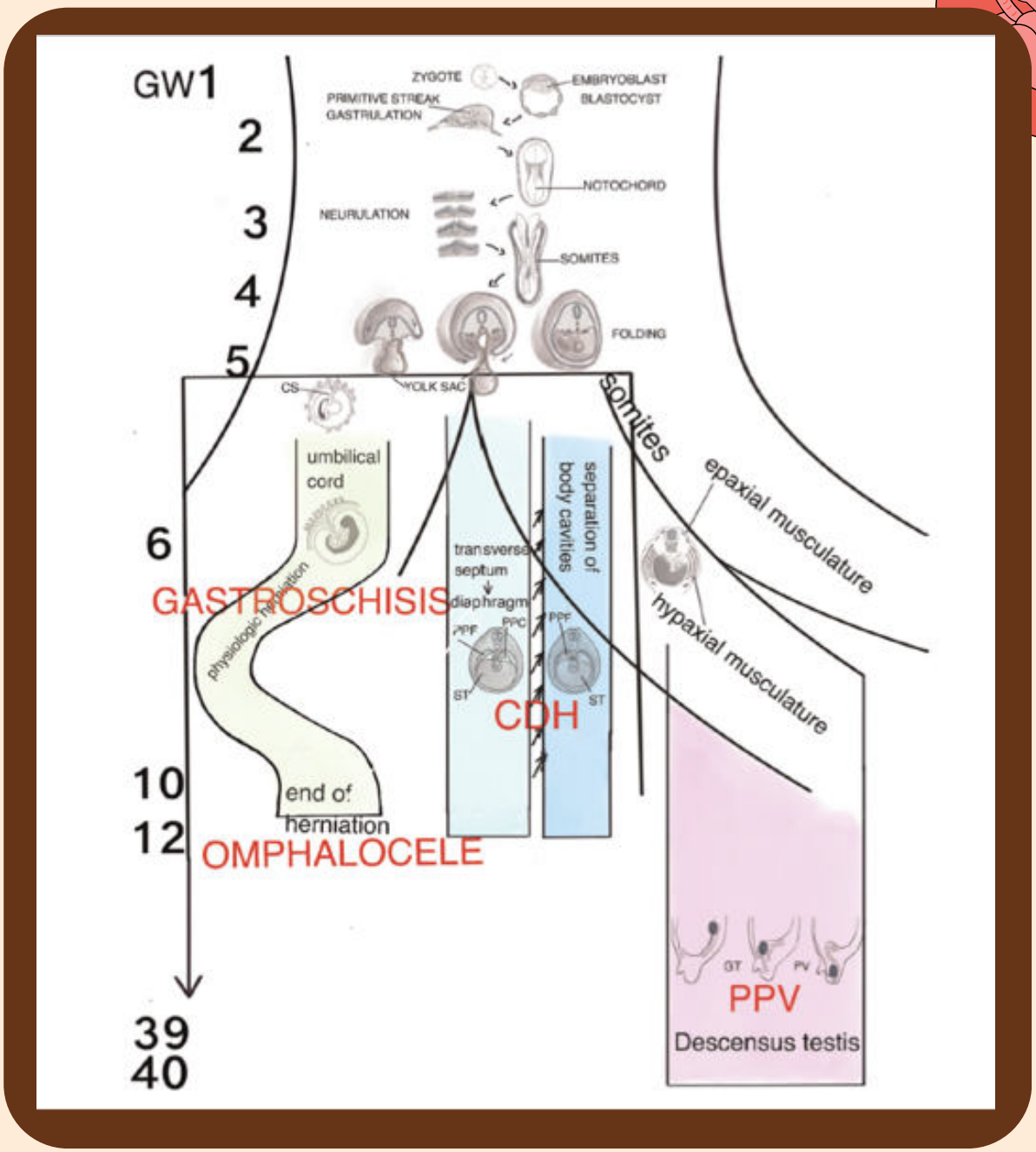
2) Third generation sequencing

3) Transcriptome analysis

4) Synthetic human embryo using human pluripotent stem cells



HUMAN ORGANOGENESIS



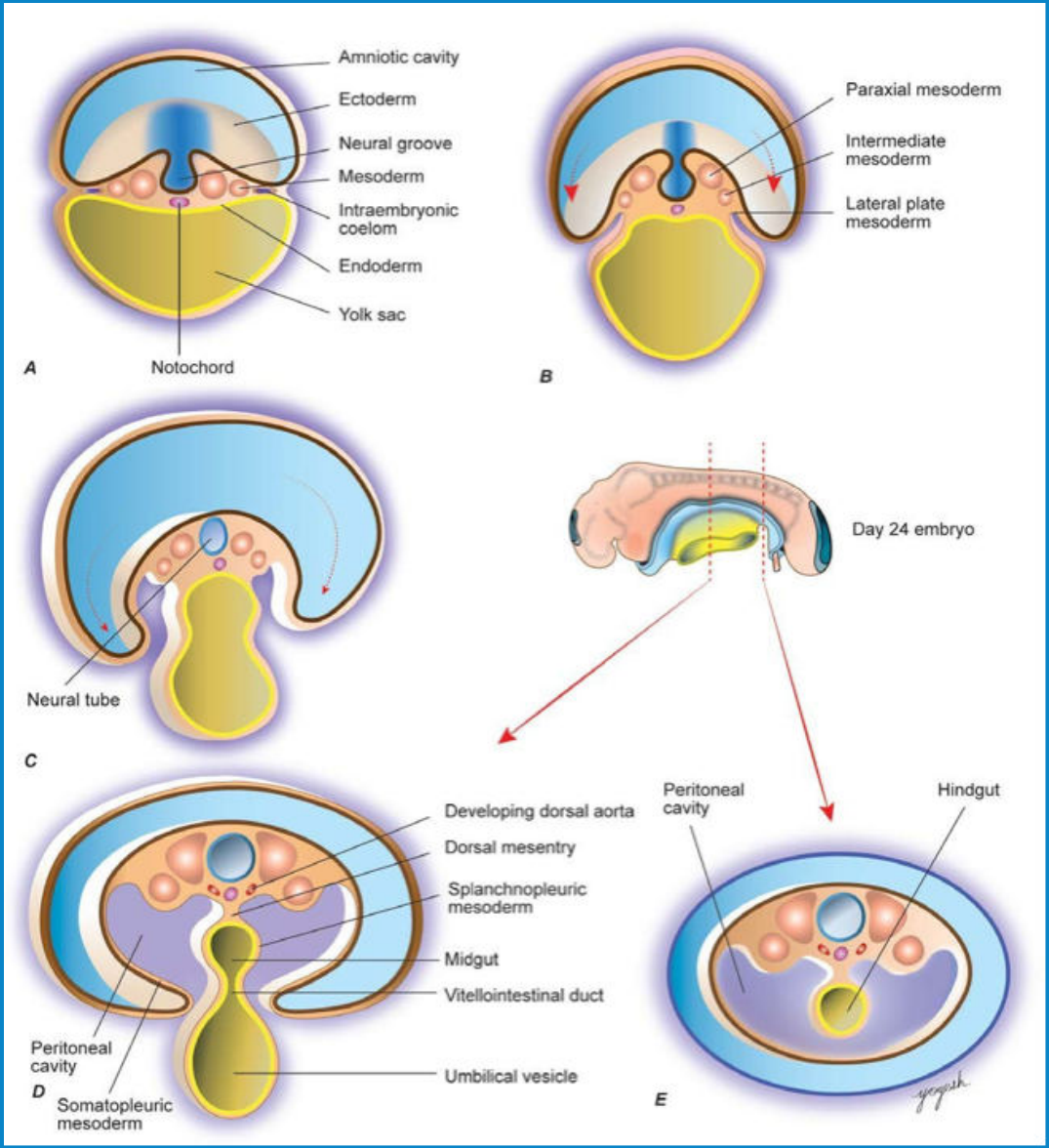
Schematic representation of human organogenesis showing various stages of development of human embryo.

Abbreviations :-

GW = Gestational week, CS = Connecting stalk, PPF = pleuro-peritoneal fold, PPC = Pleuro-peritoneal canal

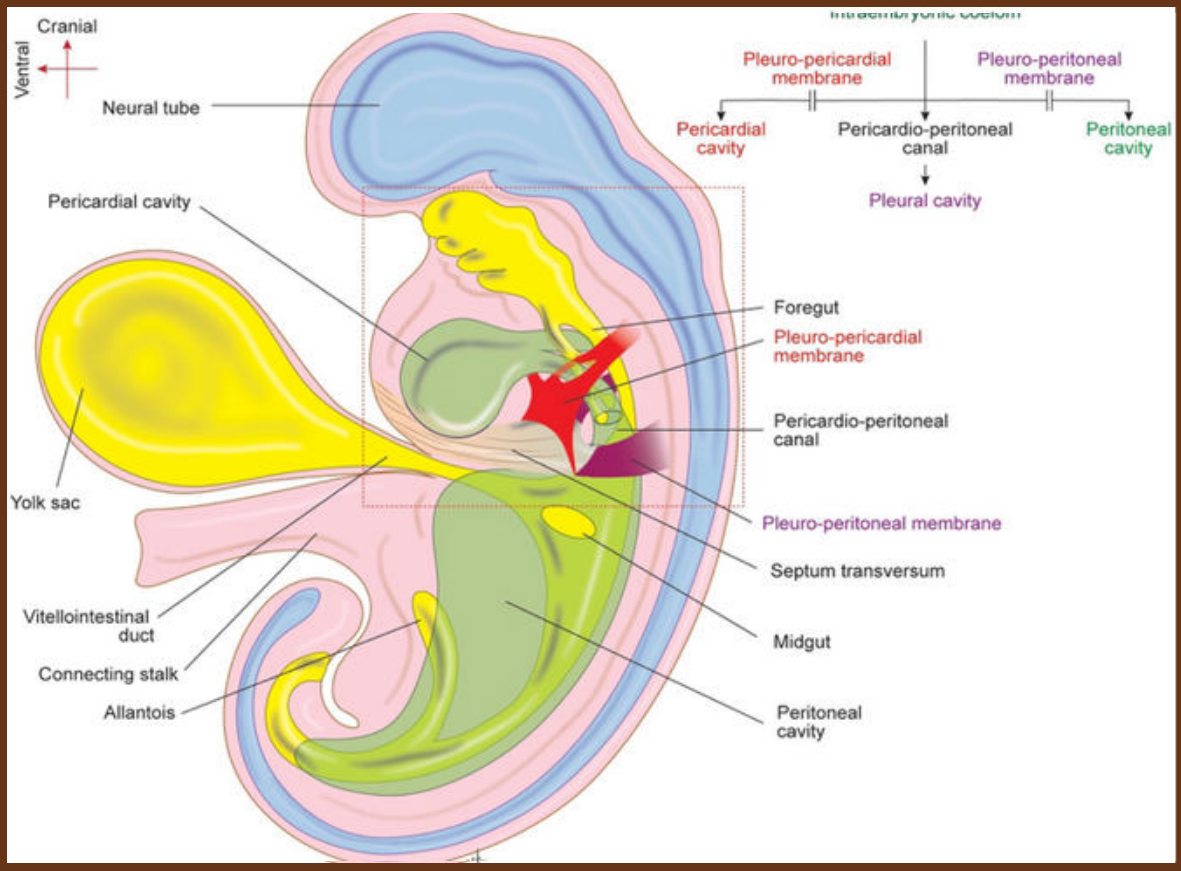
ST = Septum transversum, CDH = Congenital diaphragmatic hernia, GT = Gubernaculum testis, PV = Processus vaginalis, PPV = Patent processus vaginalis

FOLDING OF EMBRYO



- Cross sections through embryos at various stages of development to show the effect of lateral folding.
- Right and left body wall are established through this lateral folding, which occurs because of the rapid growth of the somites and the Lateral plate mesoderm.

Establishment of the Body Cavities and First Body Wall Closure



- Both the ectodermal layer and the somatopleuric layer fuse in the midline ventral to the umbilicus so the primary ventral body wall is composed of Lateral plate mesoderm and the overlying ectoderm.
- GATA 4 deficient mice – exhibit severe defects in the ventral body wall because of disrupted cranio-caudal and ventro-lateral folding.

Development of Diaphragm

Pleuroperitonial Membranes → **Central Tendon**

Dorsal mesentery of esophagus → **Crura of Diaphragm**

Cervical Somites → **Muscular Components**

Mesoderm of lateral body wall → **Ventrolateral part**

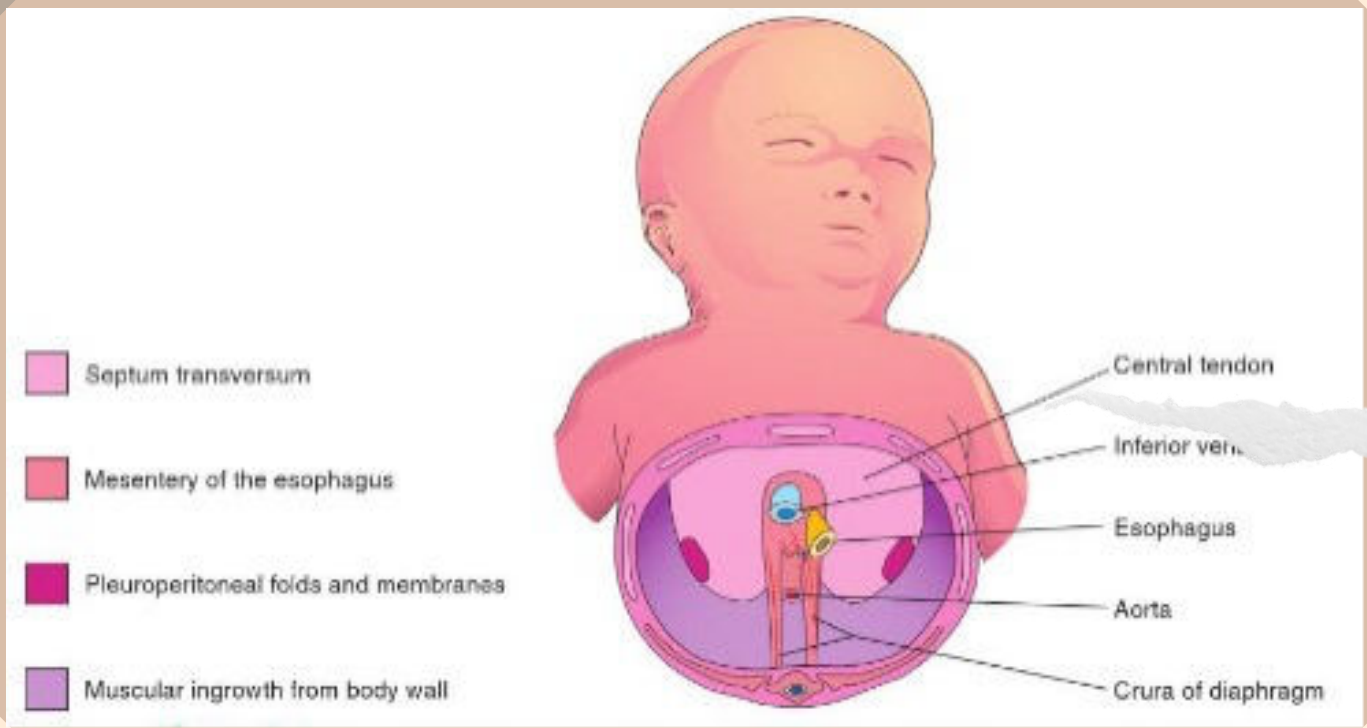
↓

DIAPHRAGM

NECK ELONGATION, ENLARGING ~ PLEURAL CAVITY, DEVELOPING HEART

↓

Descent of diaphragm: 4th week - cervical region
6th week - definitive position

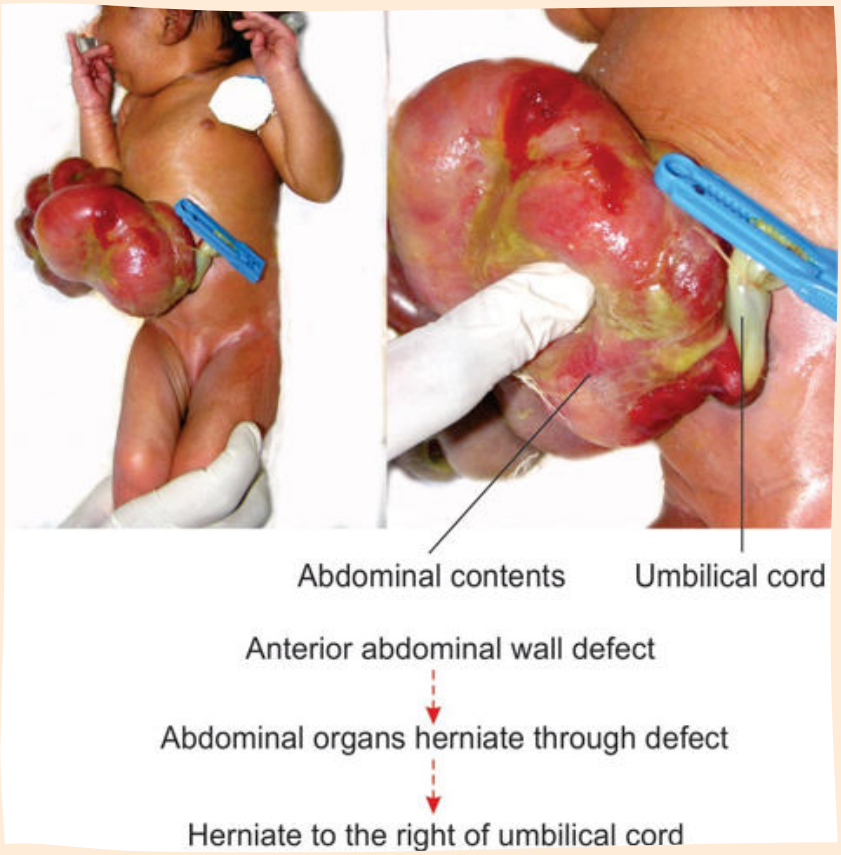


PHYSIOLOGICAL UMBILICAL HERNIA AND 2ND BODY WALL CLOSURE

- It is a natural, normal phenomenon which shows protrusion of midgut loop (herniation) outside the abdominal cavity through umbilical opening.
- Duration: From 6th week to 12th week of IUL
- Reduction of physiological hernia occurs at ~10 weeks of embryonic period.

- Physiology: Abdominal cavity is smaller to accommodate rapidly elongating gut. It results into the midgut loop herniation. The midgut rotation and increase in abdomen size accommodates midgut in the abdominal cavity.
- Muscles are classified according to the nerves involved: Ventral hypaxial and dorsal epaxial. The hypaxial muscles, which are accompanied by ventral rami, are responsible for ventral body wall closure.
- Rectus abdominis and the external and internal oblique abdominis muscles develop before the return of the intestinal loop into the abdominal cavity.
- They migrate to their original position after reduction of physiological hernia.

Anterior abdominal wall Defects

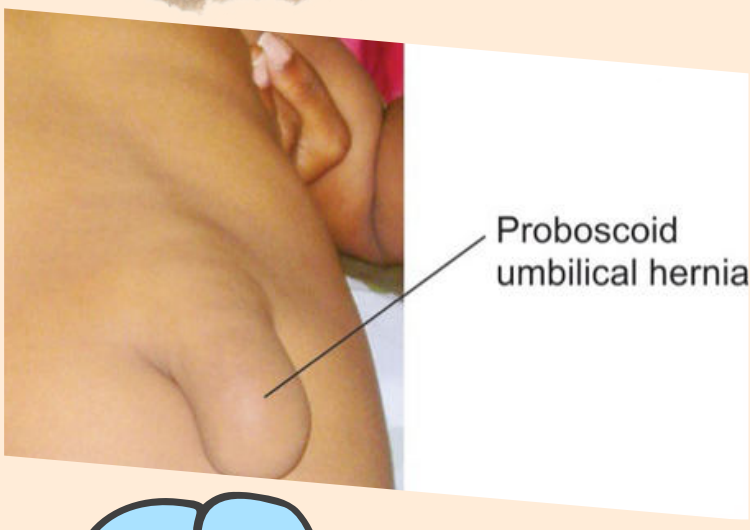


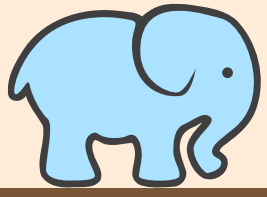
Gastroschisis

- Due to failure of formation of ventral body wall.
- Coils of intestine and other abdominal viscera protrude outside.
- Differs from omphalocele in that there is the absence of parietal sac covering the contents and it lies usually on the right side of umbilical cord.
- (in omphalocele, cord attaches to the her peritoneal sac)

Proboscoid umbilical hernia

- Protrusion of abdominal contents through a defective anterior abdominal wall at the umbilicus.
- If the umbilical hernia is elongated, it is called proboscoid umbilical hernia (like elephant trunk).
- Usually, umbilical hernia regresses spontaneously by 2–3 years of age, but proboscoid umbilical hernia often requires surgical correction.





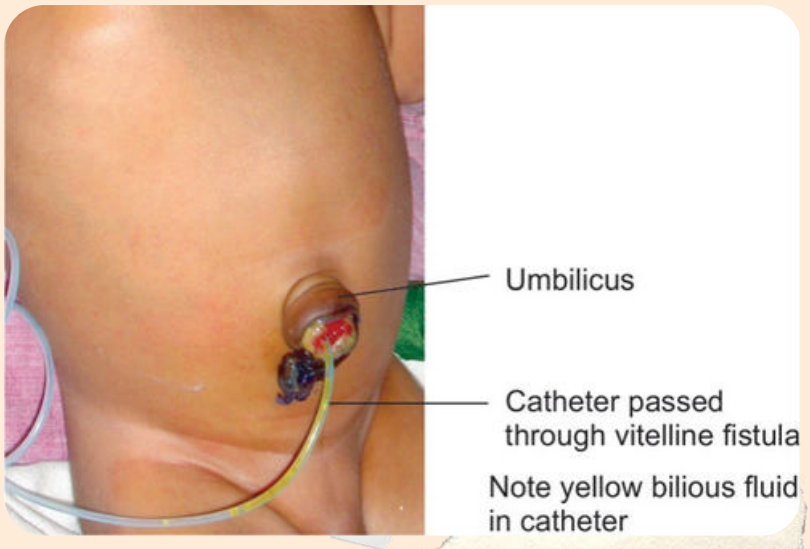
Omphalocele

- Rare abdominal wall defect Abdominal contents remains outside of the abdomen in a sac.
- Sac is formed from an outpouching of peritoneum, protrudes in the midline, through the umbilicus.

Omphalocele minor and major

- Omphalocele – abdominal wall defect in that abdominal contents are present in the cord outside the abdominal cavity.
- Omphalocele minor – only a few loops of gut in the sac.
- Omphalocele major – contain most of abdominal organs, including liver.

Patent vitellointestinal duct



- Vitellointestinal duct connects midgut loop to the umbilical vesicle.
- Usually, vitellointestinal duct obliterates during 5th–6th weeks of IUL.
- Persistent vitellointestinal duct produces vitelline fistula causing discharge of yellow bilious fluid from the umbilicus.

FINAL REMARKS

- **Taking the rising prevalence of abdominal cavity and wall defects into account, the possibilities now opening regarding surgical care and extended genetic clarification which offer new approaches to therapy.**
- **The heterogeneity of disease patterns and varieties resulting from this and interruption of developmental process underlines the importance of embryology for clinicians starting with the diagnosis up to the therapy.**
- **Comprehensive overview of embryogenesis that are crucial for the normal development of the abdominal wall and the body cavities.**

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MESSAGE FROM EXECUTIVE DIRECTOR

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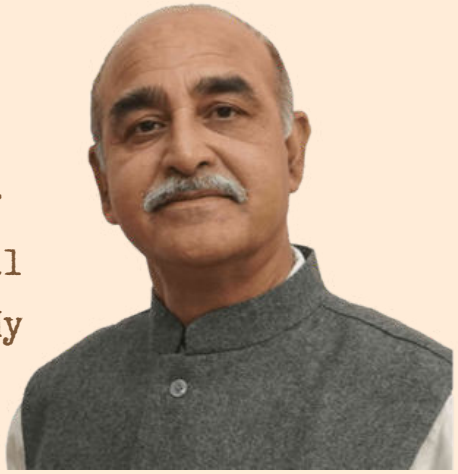

I heartily congratulate the Department of Anatomy for bringing this informative newsletter on the anatomical explanation of the Anterior abdominal wall defects. My best wishes to the entire team.

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