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# د اسامة العريبي

## استاذ مساعد الجراحة العامة



# DIAPHRAGMATIC HERNIA

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GENERAL SURGERY DEPARTMENT

# DEFINITION

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- It is herniation of abdominal content through diaphragm into the chest.

# **BASICS**

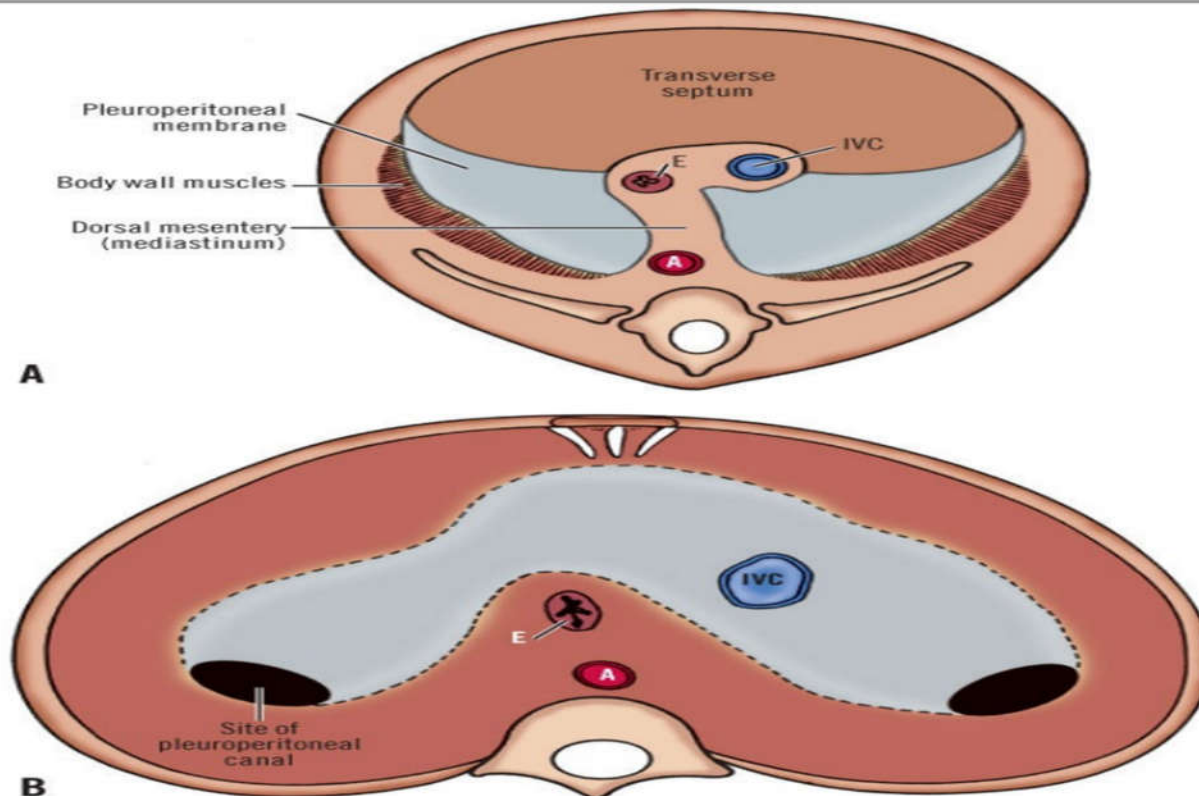
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Embryology

Anatomy



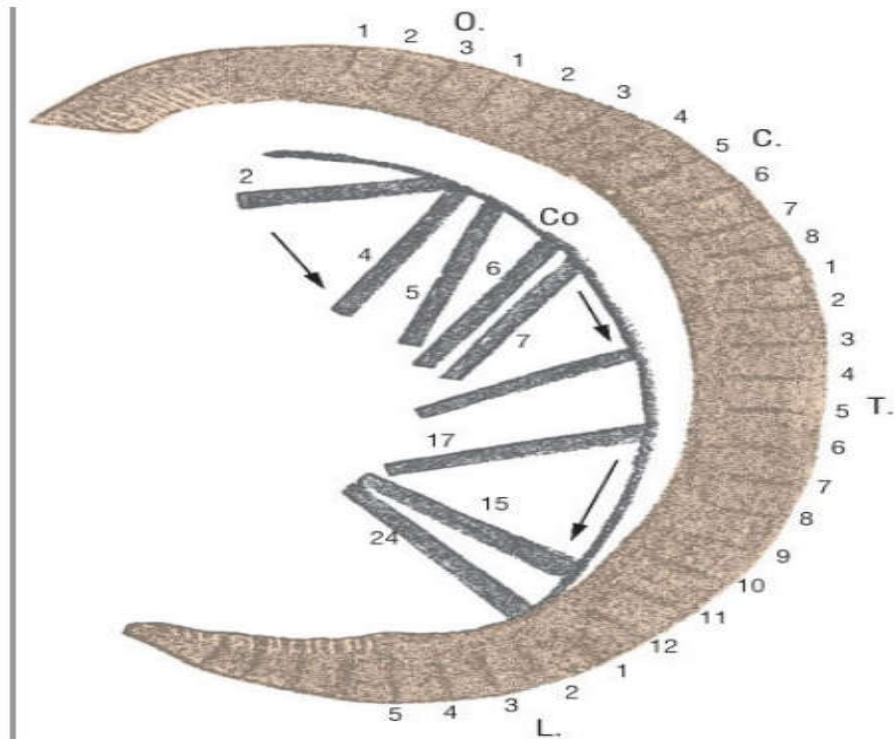
# EMBRYOLOGY



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Comparison of embryonic and adult diaphragms. **A.** Embryonic components of diaphragm. **B.** Adult diaphragm. Sites of closed pleuroperitoneal canals occupy a relatively small area in adult diaphragm. E, Esophagus; IVC, Inferior vena cava; A, Aorta. (Modified from Skandalakis LJ, Colborn GL, Skandalakis JE. Surgical anatomy of the diaphragm. In: Nyhus LM, Baker RJ, Fischer JE. Mastery of Surgery, 3rd Ed. Boston: Little, Brown, 1997; with permission.)

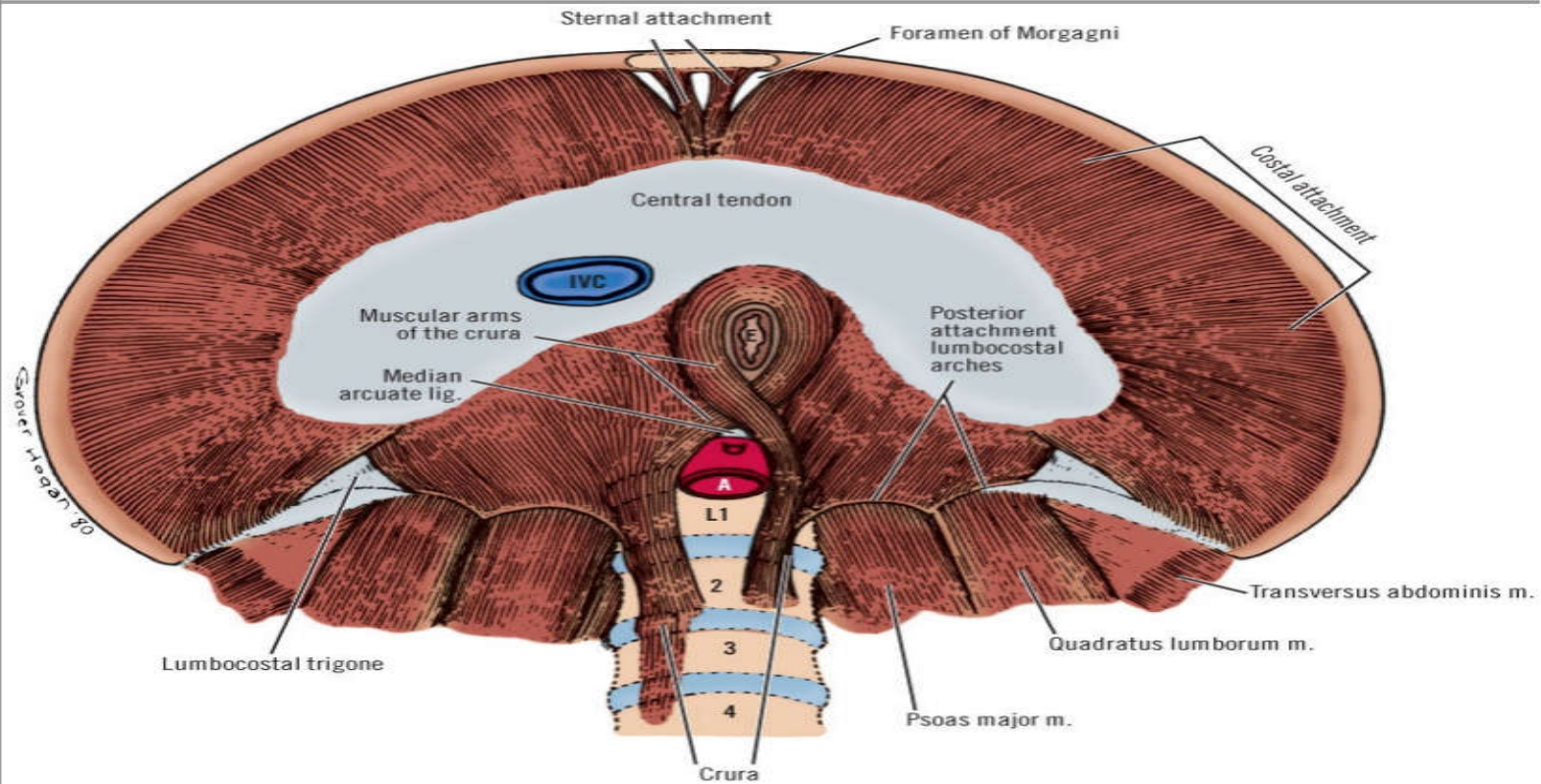
# DESCENT



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**Descent of diaphragm.** Numbers on right indicate vertebral levels. Numbers on left indicate embryonic length from 2 mm to 24 mm. Orientation of transverse septum at given embryonic length shown on left. Arrows indicate stages of very rapid growth and descent of septum. O, Occipital region; C, Cervical; T, Thoracic; L, Lumbar; Co, Coelom. (Modified from Mall FP. Coelom and diaphragm. In: Keibel F, Mall FP, eds. Manual of Human Embryology. Philadelphia: JB Lippincott, 1910; with permission.)

# ANATOMY

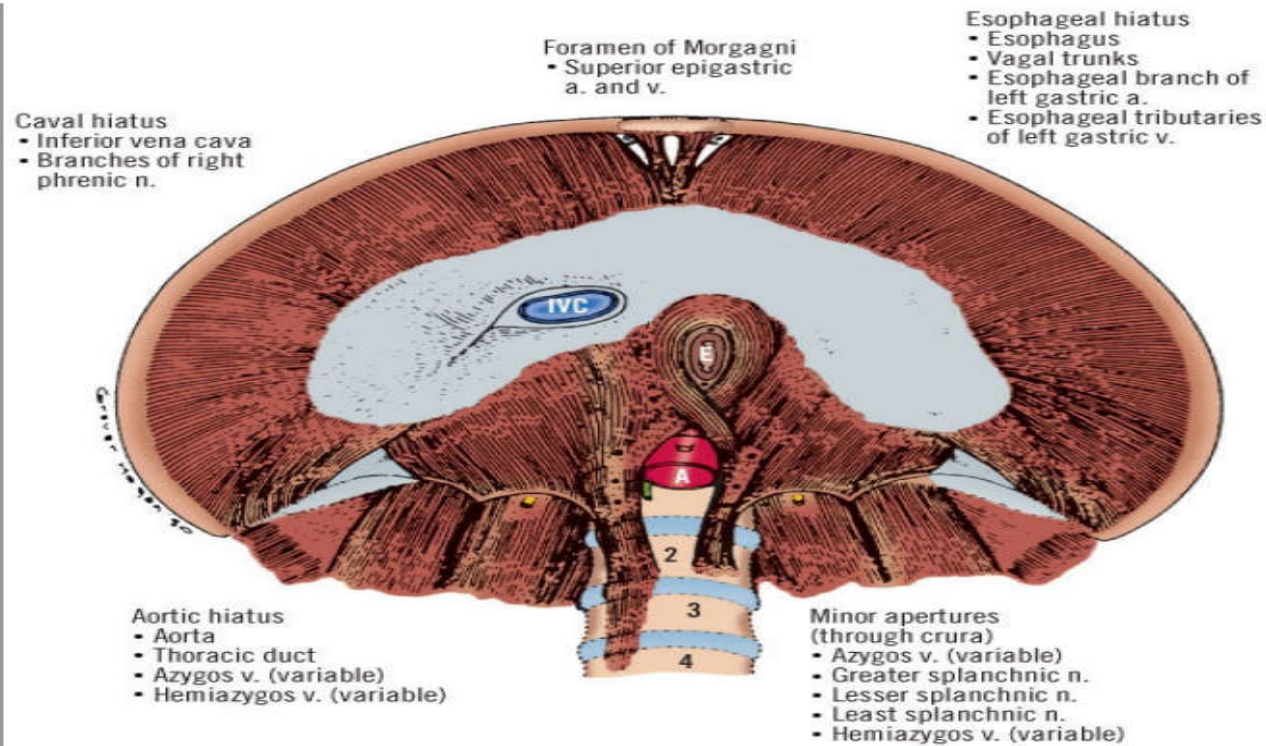


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**Attachments of muscles of diaphragm seen from below.** (Modified from Skandalakis LJ, Colborn GL, Skandalakis JE. Surgical anatomy of the diaphragm. In: Nyhus LM, Baker RJ, Fischer JE. Mastery of Surgery, 3rd Ed. Boston: Little, Brown, 1997; with permission.)



# OPENINGS

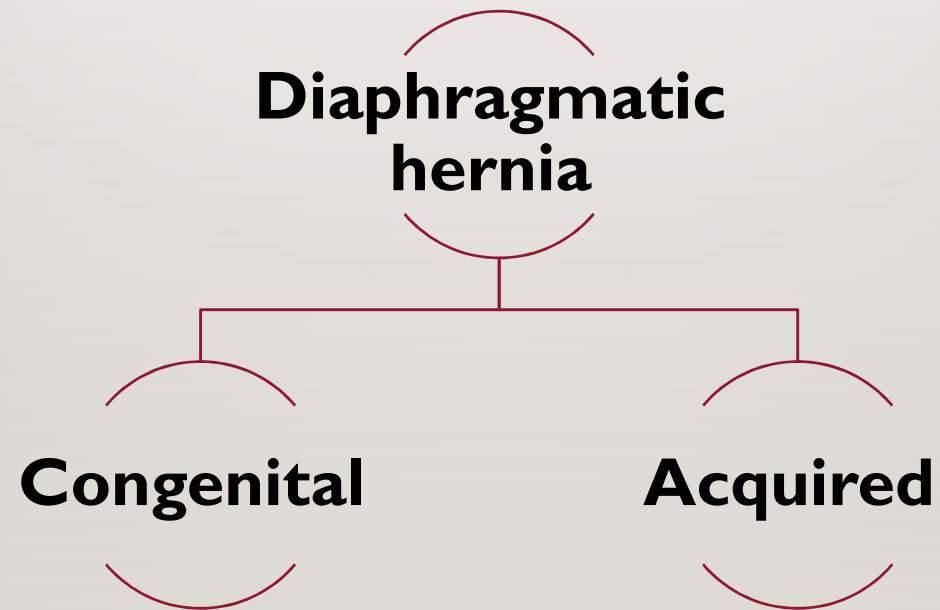


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Apertures of diaphragm seen from below with traversing structures. E, Esophagus; IVC, Inferior vena cava; A, Aorta. (Modified from Skandalakis LJ, Colborn GL, Skandalakis JE. Surgical anatomy of the diaphragm. In: Nyhus LM, Baker RJ, Fischer JE. Mastery of Surgery, 3rd Ed. Boston: Little, Brown, 1997; with permission.)

# CLASSIFICATION

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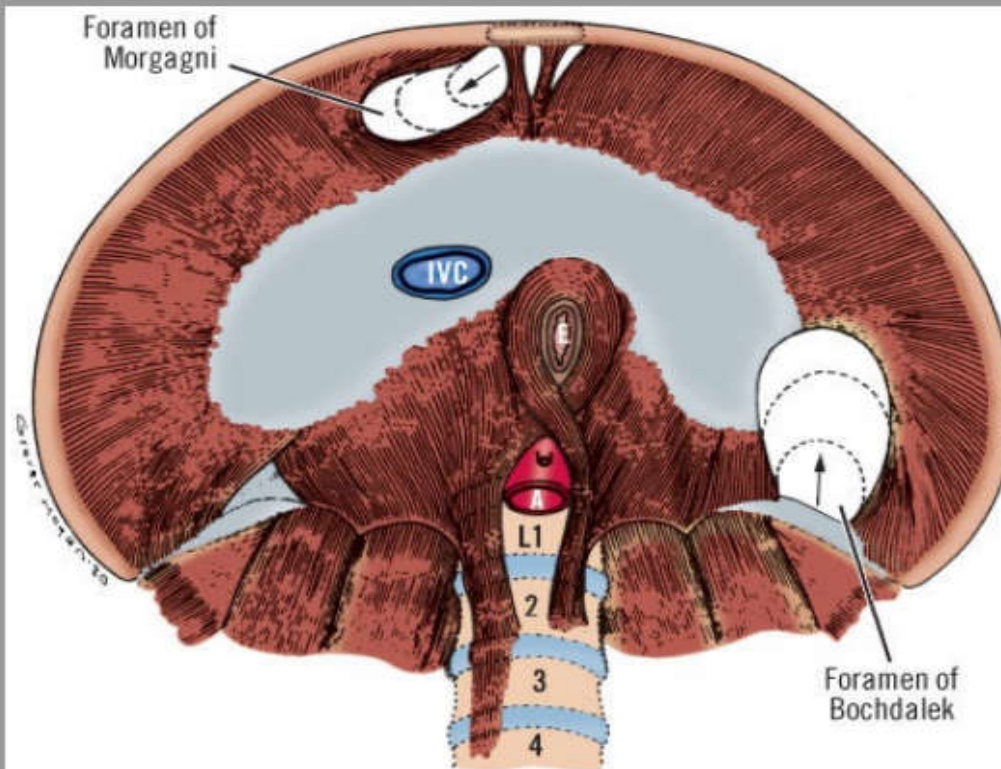
# Congenital

**Eventration hernia**

**Hernia through foramen  
Morgagni**

**Hernia through foramen  
Bochdalek**

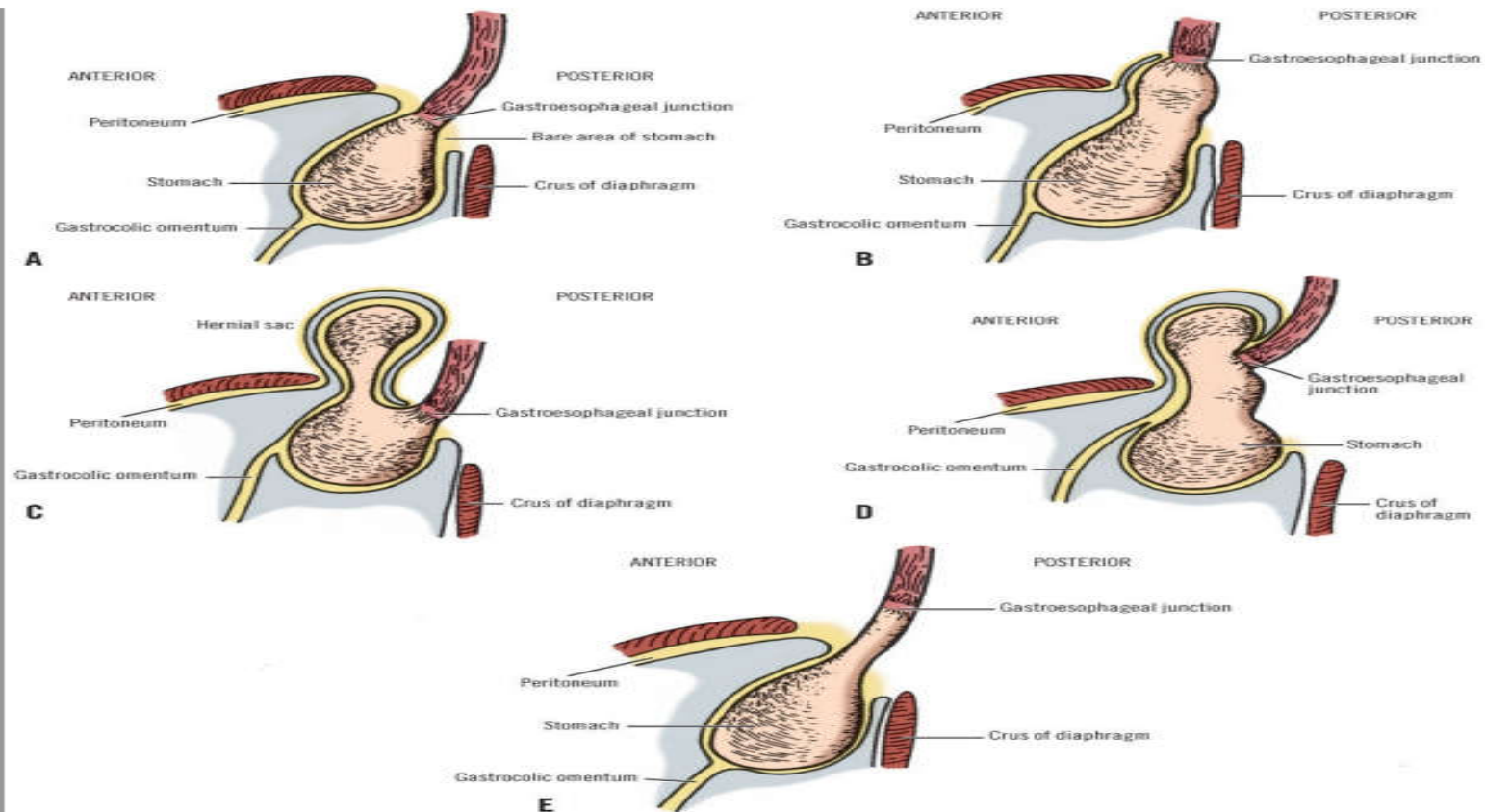
**Congenital oesophageal(rare)**



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Diaphragm from below, showing foramen of Bochdalek and foramen of Morgagni. Both are weak areas of potential herniation. Arrows indicate direction of enlargement after herniation has begun. (Modified from Skandalakis LJ, Colborn GL, Skandalakis JE. Surgical anatomy of the diaphragm. In: Nyhus LM, Baker RJ, Fischer JE. Mastery of Surgery, 3rd Ed. Boston: Little, Brown, 1997; with permission.)





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**Esophageal hiatus (sagittal section).** **A.** Normal anatomy. **B.** Sliding hiatal hernia. **C.** Paraesophageal hiatal hernia. **D.** Combined sliding and paraesophageal hernia. **E.** Congenital short esophagus. (Modified from Gray SW, Skandalakis LJ, Skandalakis JE. Classification of hernias through the esophageal hiatus. In: Jamieson GG, ed. Surgery of the Oesophagus. Edinburgh: Churchill Livingstone, 1988; with permission.)

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**Acquired**

**Traumatic**

**Esophageal  
hiatus**(commonest  
type)

# **ETIOLOGY OF CONGENITAL DIAPHRAGMATIC HERNIA**

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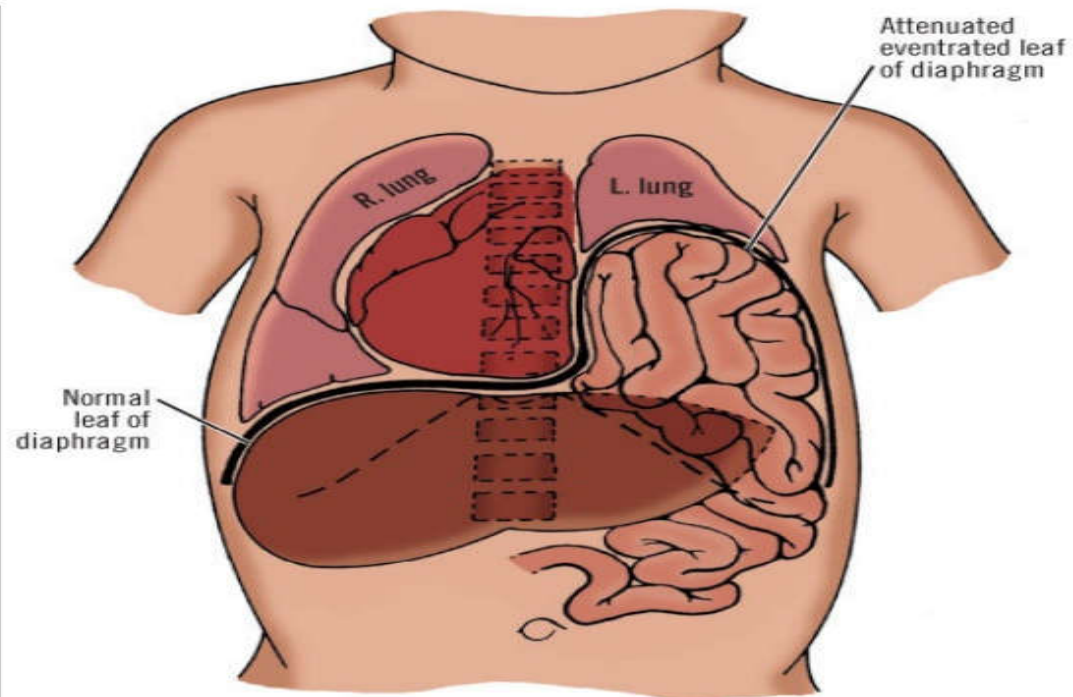
- **Genetic**
- **Decreased lung fluid pressure**
- **Failure of the closure of pleuroperitoneal canal (foramen of Bochdalek)**
- **Early return of bowel into peritoneal cavity from physiological hernia**

# EVENTRATION

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- It is weakening of diaphragm due to atrophy and loss of muscle of a part or all of one leaf of the diaphragm, with thin fibrous tissue formation, covered with pleura and peritoneum on either side.
- Diaphragm is attenuated and inactive.





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**Eventration of (left) diaphragm.** Herniated abdominal organs remain beneath attenuated but intact leaf of diaphragm. Both lungs are compressed and mediastinum is shifted to right. Compare with Fig. 8-7. (Modified from Skandalakis LJ, Colborn GL, Skandalakis JE. Surgical anatomy of the diaphragm. In: Nyhus LM, Baker RJ, Fischer JE. Mastery of Surgery, 3rd Ed. Boston: Little, Brown, 1997; with permission.)

# CLASSIFICATION OF EVENTRATION

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- 1. Congenital—marked decrease in the muscle fibres in the diaphragm, clinically it may mimic CDH with sac.
- 2. Acquired or secondary—(a) Phrenic nerve palsy due to trauma (with Erb's palsy); viral—usually in adults (Polio, Herpes zoster, Influenza, Diphtheria). (b) Neoplasia. (c) Autoimmune neuropathy involving diaphragm or phrenic nerve. (d) Iatrogenic.
- Most of them present in the infancy and childhood. A few of them escape to adulthood.
- This thin diaphragm is raised higher and immobile. It is actually not a true herniation. But features mimic hernia.

# PRESENTATION

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- Asymptomatic, wheezing, recurrent LRTI, exercise intolerance, extreme respiratory distress.
- Symptomatic patients have functional deficit in ventilation perfusion (V/P) ratio because lung growth is affected.
- Larger the defect more the hypoplasia. More the hypoplasia lesser the perfusion and severe the symptoms.
- Paradoxical movement compromises the gas exchange.

- 
- Sniff test—fluoroscopic evaluation for paradoxical movement.
  - Chest X-ray (CT scan/MRI) shows the abnormality
  - Differential diagnosis are diaphragmatic hernia through foramen Bochdalek.
  - Condition causes respiratory embarrassment
  - Treatment is plication of diaphragm through laparotomy



# INDICATIONS FOR SURGERY

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- Symptomatic patients
- Decreased ventilation perfusion ratio
- Prolonged (>3 to 6 months) exertional dyspnoea
- Phrenic nerve palsy
- Impairing daily activity in idiopathic/viral



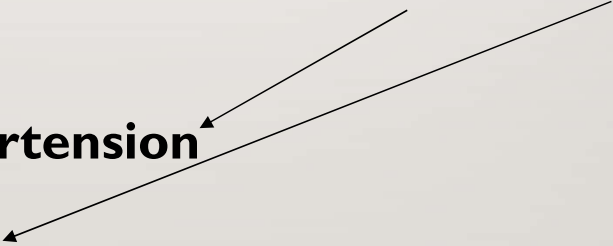
# HERNIA THROUGH FORAMEN BOCHDALEK (THROUGH PLEUROPERITONEAL CANAL)

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- (95% Left Sided, Only 5% Right Sided)
- It is commonest congenital diaphragmatic hernia.
- This is a developmental defective condition, due to failure of fusion of pleuroperitoneal canal leaving a direct communication between pleura and peritoneum on left side. This allows herniation of contents of abdomen into the left side thorax.
- Common content is colon. Occasionally small bowel, stomach are the contents.
- 80% cases do not have hernial sac.
- Only 20% cases has got sac.

# PATHOGENESIS

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- **Pulmonary hypoplasia → Acidosis → Pulmonary vascular bed spasm**
  - **Persistent pulmonary hypertension**
  - **Persistent fetal circulation**
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- ```
graph TD; A["Pulmonary hypoplasia → Acidosis → Pulmonary vascular bed spasm"] --> B["Persistent pulmonary hypertension"]; A --> C["Persistent fetal circulation"];
```

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- Hypoplasia not only on left side, it may be bilateral.
  - Generations of bronchial branches decreased.
  - Extension of tunica media beyond respiratory bronchioles.
  - Decreased total lung mass
  - Incidence: 1 in 3000 live births, M:F—2:1.
  - 90% present in newborn period.
  - 90% of CDH are Bochdalek hernias
  - Left—80%, right—15%, bilateral—5%.



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Defects are large in babies and small in adults. x Associated anomalies—10 to 50%, •  
commonest—nonfixation/ midgut malrotation. Other anomalies—CNS, cardiac are  
known to occur and commoner with large/bilateral CDH. x Very small percentage of  
patients escape and pass on to adulthood. Incidence—0.17 to 6% x Incidental detection  
while evaluating for some other problem. So usually they are asymptomatic

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  - Associated anomalies—10 to 50%, commonest—nonfixation/ midgut malrotation. Other anomalies—CNS, cardiac are known to occur and commoner with large/bilateral CDH.
  - Very small percentage of patients escape and pass on to adulthood. Incidence—0.17 to 6%
  - Incidental detection while evaluating for some other problem. So usually, they are asymptomatic

# **POOR PROGNOSTIC CRITERIAS IN BOCHDALEK HERNIA**

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- Early antenatal detection (before 5th month)
- Small left ventricle
- Large diaphragmatic defect / hemiagenesis
- Stomach in chest
- Polyhydramnios

# CLINICAL FEATURES

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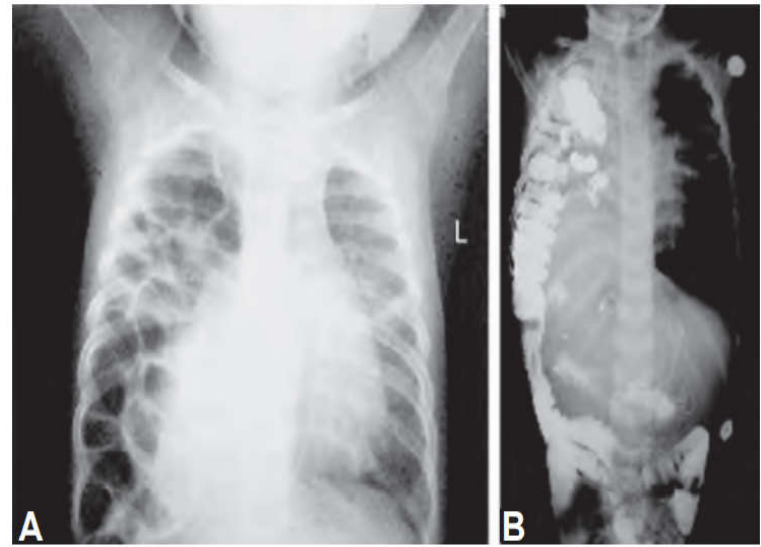
- Respiratory embarrassment
- Scaphoid abdomen
- Bowel sounds in left side of chest
- Mediastinal shift towards right side
- Occasionally features of intestinal obstruction

# INVESTIGATIONS:

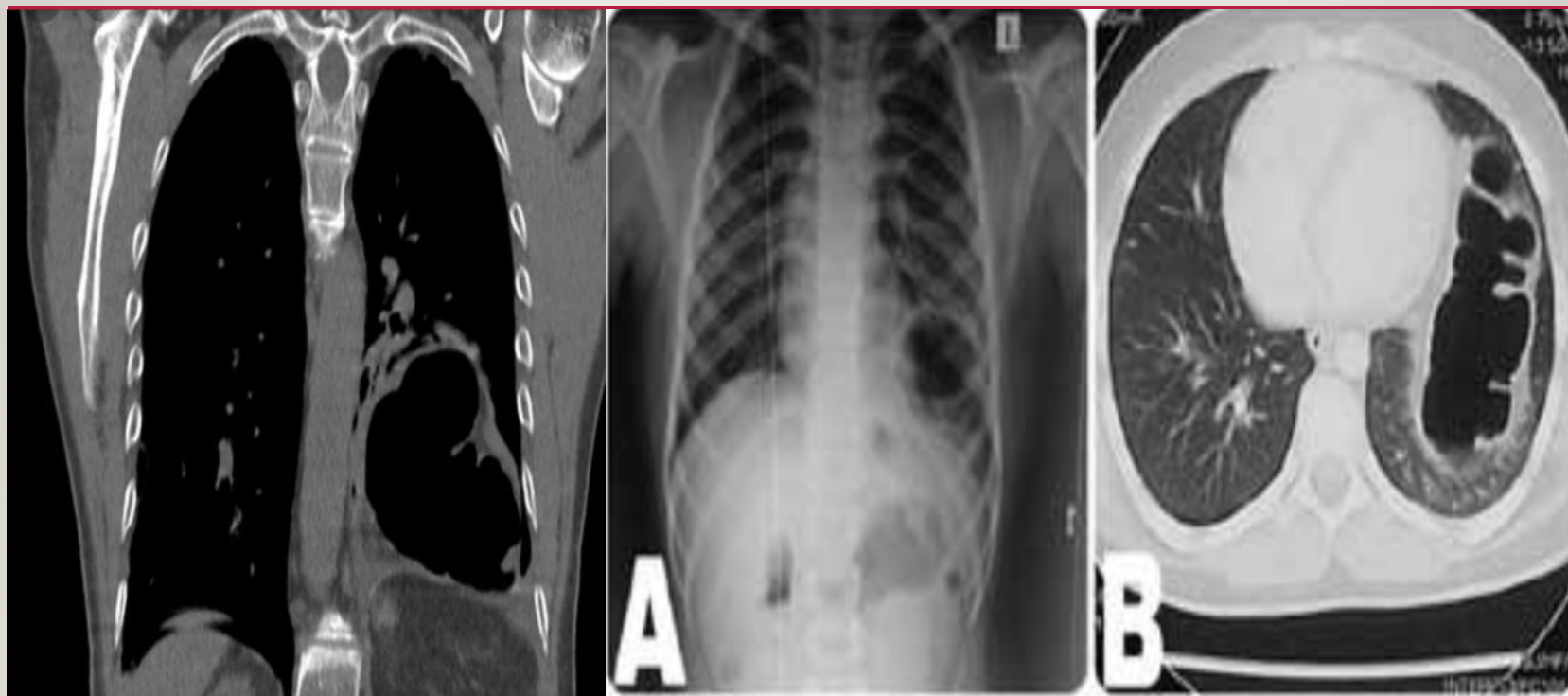
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- Chest X-ray,
  - barium enema (common) or barium meal,
  - arterial blood gas analysis (ABG).
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- Treatment x Laparotomy and dissection of the sac (when present) and closure of the defect in the diaphragm (using nonabsorbable suture material).





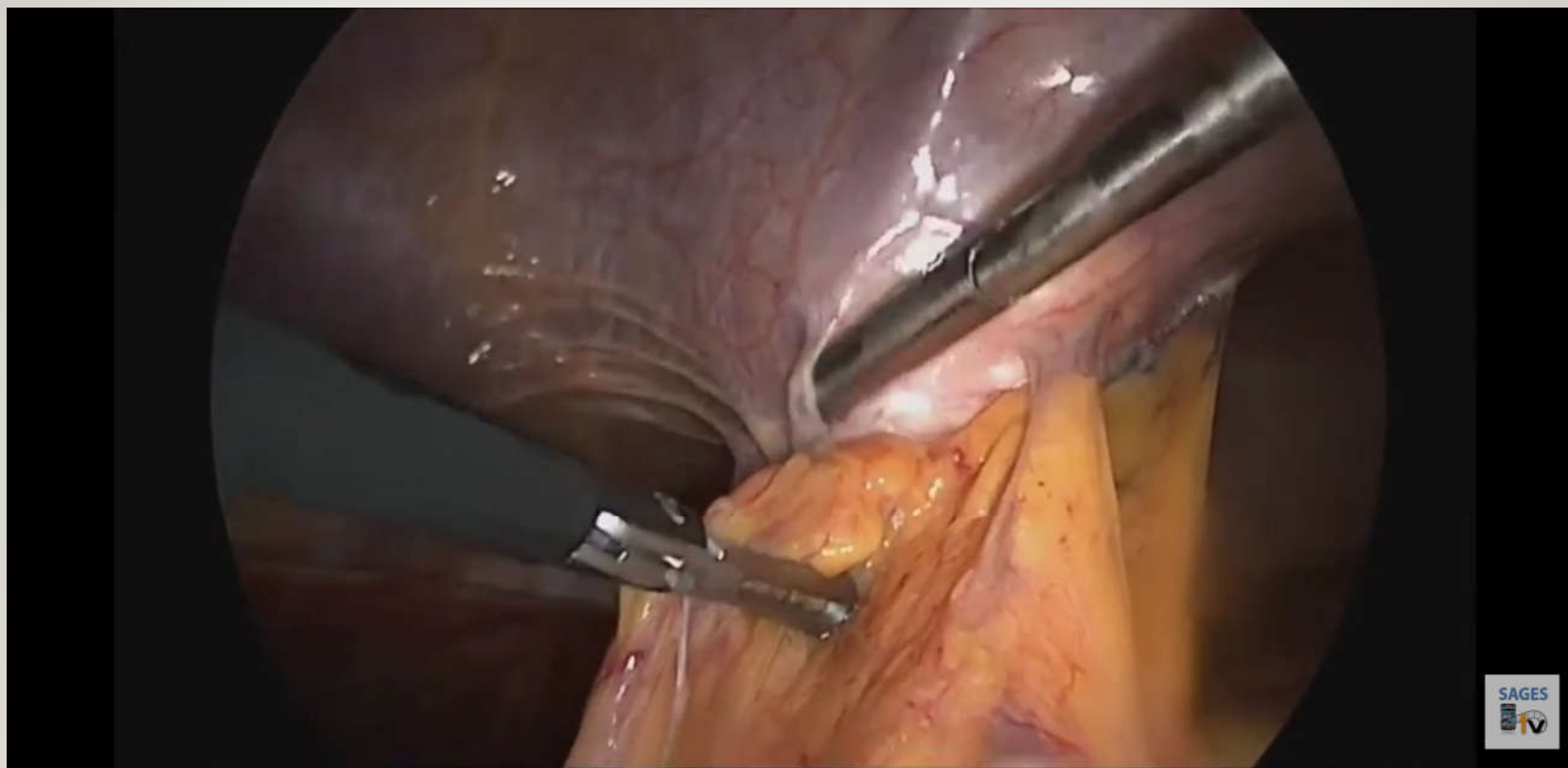
**Figs 28.38A and B:** (A) Plain X-ray chest; (B) Barium enema, showing bowel loops within thoracic cavity on the right side (diaphragmatic hernia).

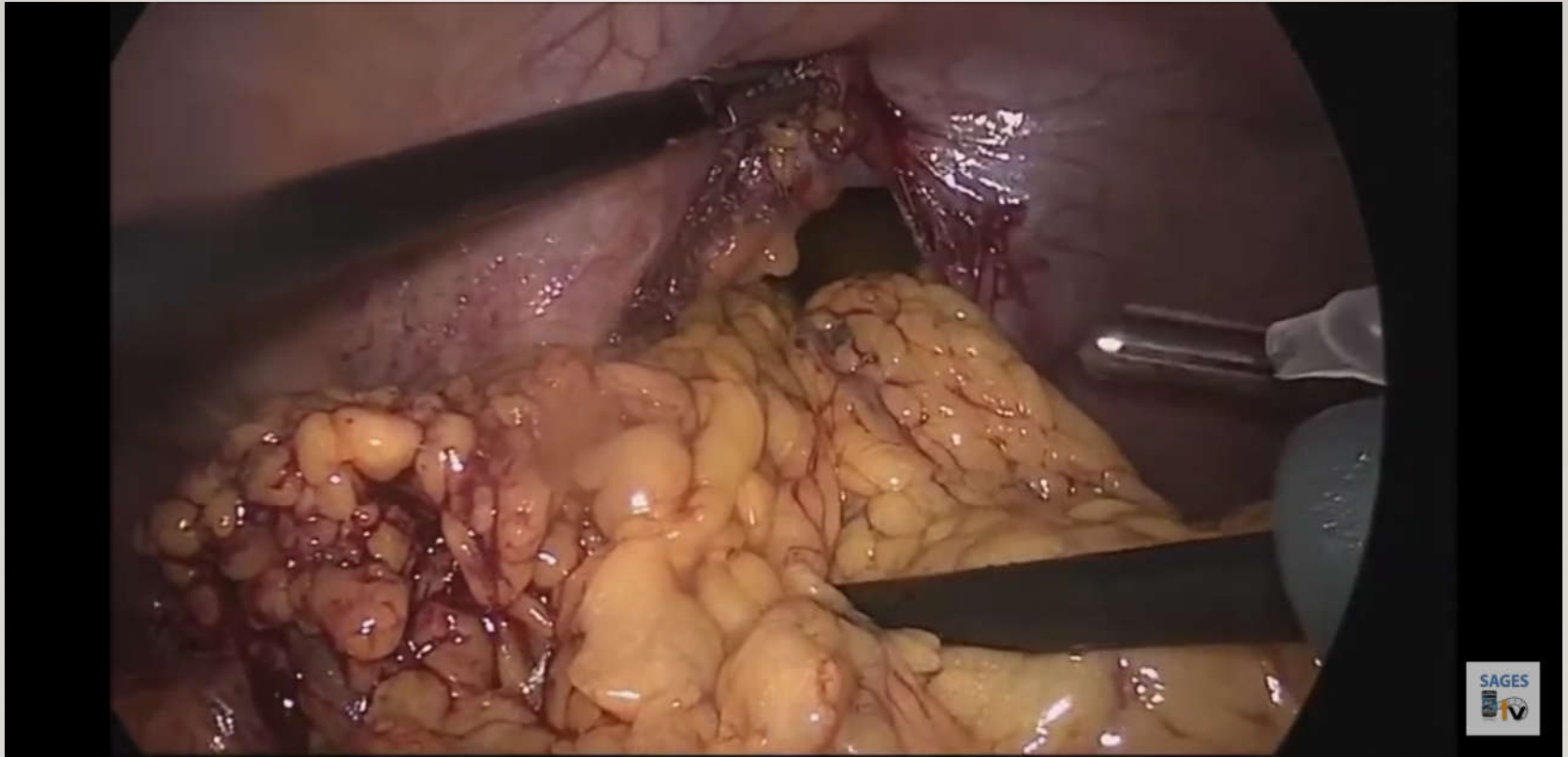


# TRIAD OF CONGENITAL DIAPHRAGMATIC HERNIA (CDH)

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- Respiratory distress
  - Scaphoid abdomen
  - Mediastinal shift (Pseudodextrocardia)
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- **Association of CDH :**
- Pulmonary hypoplasia with persistent fetal circulation—is the actual cause for hernia
  - Respiratory acidosis







# HERNIA THROUGH FORAMEN OF MORGAGNI

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- The defect lies between the sternal and costal attachments of diaphragm and is situated in front, towards right.
- Colon is commonest content.
- Usually, it is symptom free.

# TRAUMATIC DIAPHRAGMATIC HERNIA

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- Either on right or left side,
- Causes:
- Road traffic accidents,
- Crush injuries,
- Penetrating injuries, or
- Blunt injuries.

# PRESENTATION

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- Patient is under shock.
- On right side along with the liver, the intestines may also get herniated.
- Patient is pale, presents with respiratory distress, guarding and rigidity over the abdomen.
- **Investigations**
- X-ray chest and abdomen.
- US abdomen.
- Often CT scan of abdomen and chest is done.

# TREATMENT

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- Immediate laparotomy and exploration is done.
- Tear in the diaphragm is sutured.
- Associated injuries in liver or spleen or bowel are treated accordingly.
- Adequate blood transfusion and antibiotics is required.
- Ventilator support is often necessary.





# **PULMONARY COMPLICATIONS DURING POSTOPERATIVE PERIOD**

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Precipitating Factors:

- Age: Common in infants and elderly.
- Sex: Common in males.
- Common in smokers.
- Common in people with chronic bronchitis, asthma, tuberculosis or COPD.
- Postoperative pain.
- Deep venous thrombosis and pulmonary embolism.
- Type of surgery: Common in thoracic or upper abdomen surgeries.

# **PULMONARY COMPLICATIONS DURING POSTOPERATIVE PERIOD**

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- Septicaemia.
- Paralytic ileus.
- Anaesthetic complications.
- Aspiration and its problems.
- Obesity.

# COMPLICATIONS

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- Bronchopneumonia.
- Lung collapse.
- Bronchitis.
- Lung abscess.
- Adult respiratory distress syndrome (ARDS).
- Respiratory failure.
- Alkalosis.
- Pleural effusion or empyema.

# MANAGEMENT

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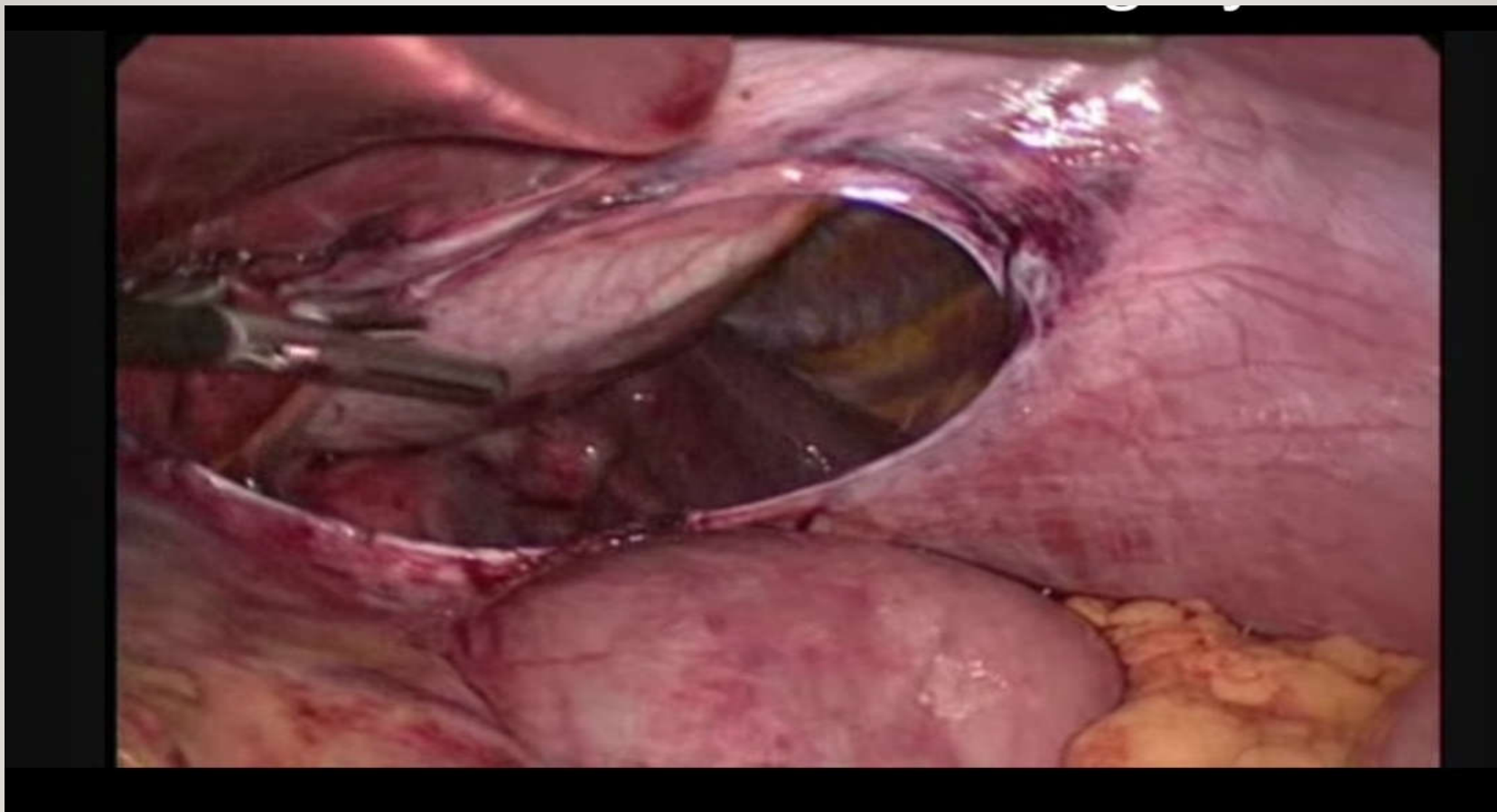
- Chest X-ray.
- Arterial blood gas analysis.
- Suction—aspiration of tracheobronchial tree.
- Respiratory physiotherapy.
- Analgesics to control pain.
- Ventilator support with endotracheal intubation.
- Tracheostomy.
- Control of sepsis by proper antibiotics

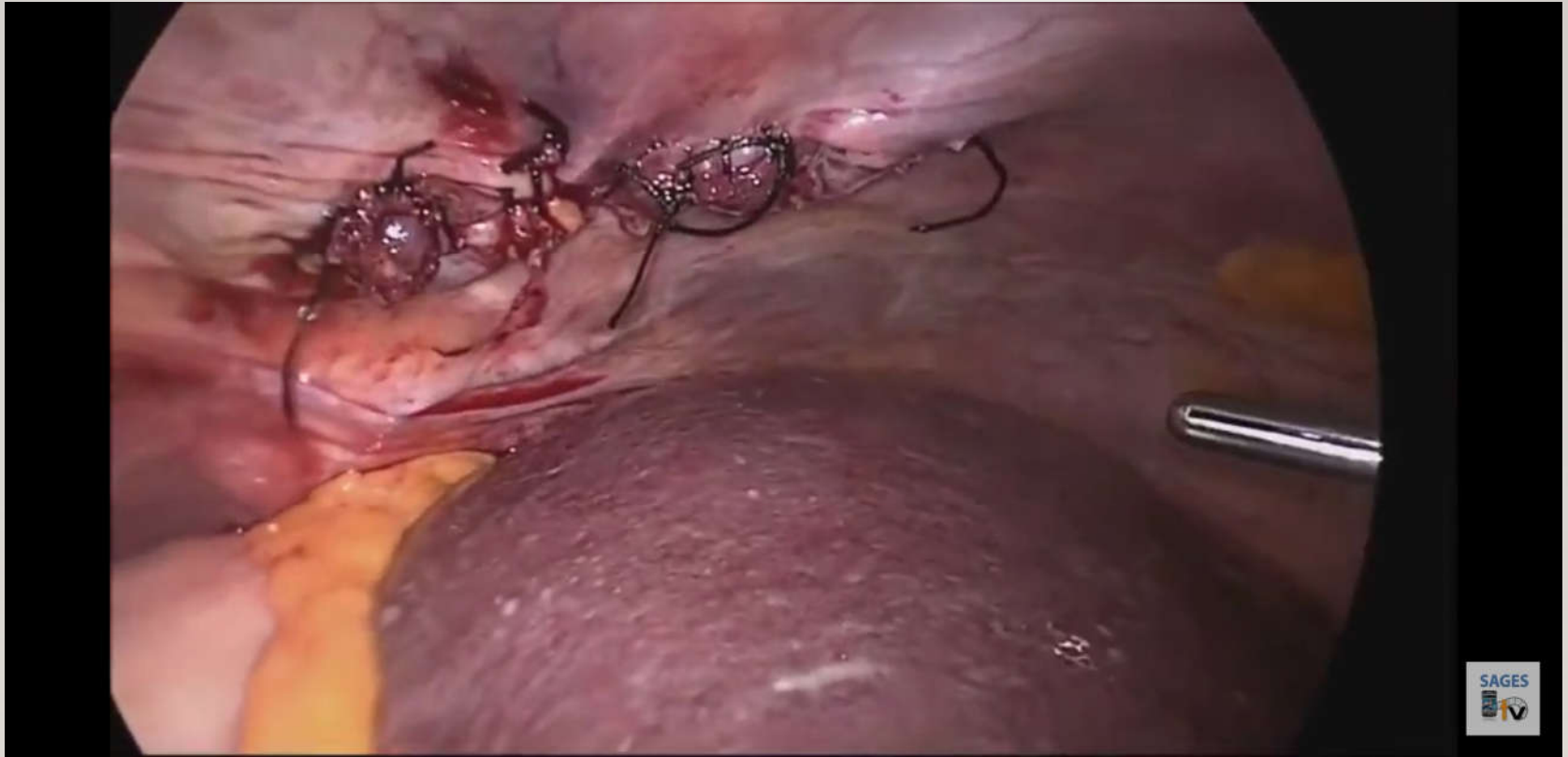
# RECENT ADVANCES

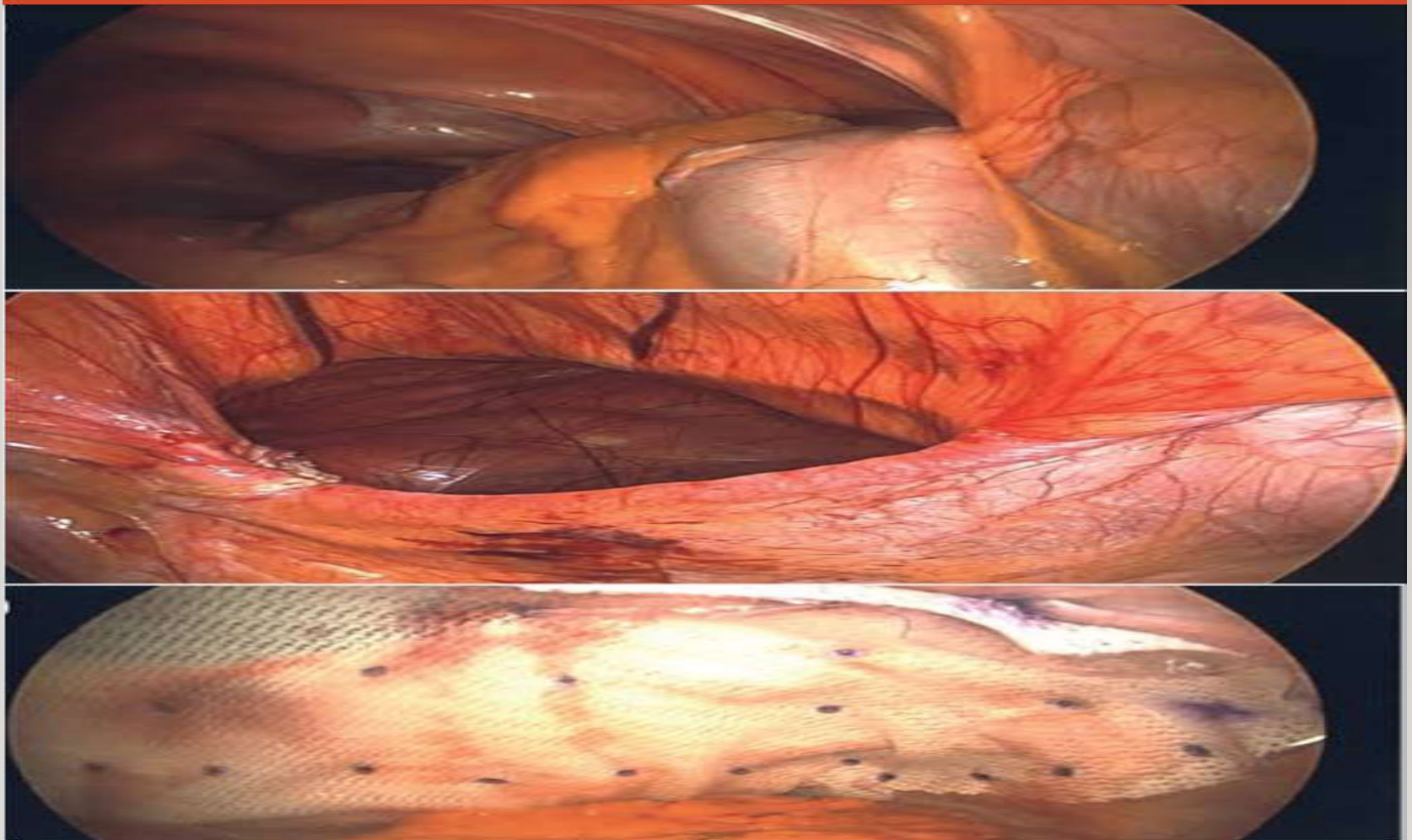
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- Laparoscopic repair
- Robotic-assisted repair











# THANKS

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