Diaphragmatic Eventration (eventration of the diaphragm)

Patient and family information, brought to you by the Education Committee of APSA

Overview - "What is it?"

The diaphragm is a dome-shaped muscle that separates the chest (containing the heart and lungs) from the belly (containing liver, stomach, intestines). It is located near the bottom of the rib cage. When this large muscle contracts, air enters the lungs (inspiration) and when it relaxes, air exits the lungs (exhalation). (See Figure 1)

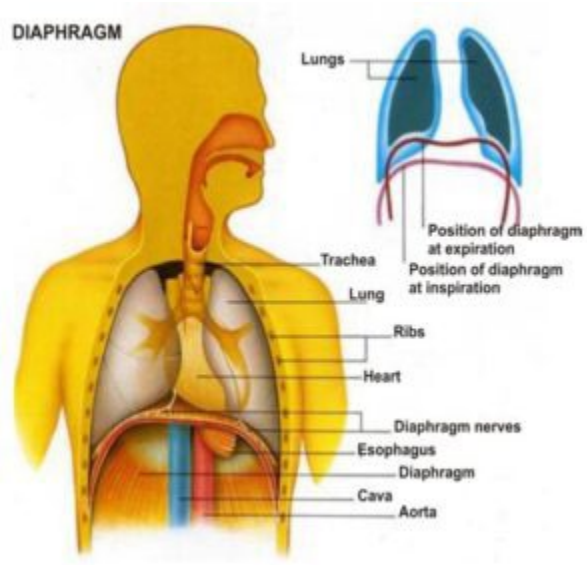

Figure 1: The Diaphragm
(image credit: ihealthspot)

In **diaphragmatic eventration**, the diaphragm is positioned in an abnormally high position as a result of lack of muscle or nerve function. Sometimes, the nerves or muscles are not well formed or may be injured. The muscle does not contract and therefore, does not move. If the muscle does not contract, it compresses against the lung and may make breathing difficult. Diaphragm eventration usually occurs on only one side (left or right).

In general, eventration happens because of two conditions:

- **Congenital:** Situation that is present at birth. It may be due to damage of the nerve that controls the movement of the diaphragm muscle or due to a thin, abnormal diaphragm.
- **Acquired:** Result of phrenic nerve injury possibly from birth trauma, chest surgery or from rare tumors of the chest.

Asymptomatic congenital diaphragmatic eventrations occur in 7-35 per 100,000 persons.

Signs and Symptoms - "What symptoms will my child have?"

Some patients with diaphragm eventration may have no symptoms at all, however, the problem may be seen in X-rays obtained for other purposes. Problems associated with eventration, may include rapid breathing, need for oxygen, inability to eat well by mouth, or poor weight gain. Other abnormalities may include nerve injury or compression, chest wall deformities, possible missing ribs, poorly developed lungs, gastric volvulus (twisting of the stomach causing vomiting), vascular abnormalities, congenital heart disease, or kidney and musculoskeletal defects.

Diagnosis - "What tests are done to find out what my child has?"

- A **physical examination** by an experienced health care provider is essential.
- **X-ray or CT scan** of the chest will show an intact diaphragm with elevation of a portion or one side (left or right) of the diaphragm muscle.
- **Ultrasound** can be used to visualize if the diaphragm moves in the correct direction during breathing. When one inhales, the diaphragm moves downward. However, a paralyzed diaphragm will move in the opposite (upward) direction.

Treatment - "What will be done to make my child better?"

Medical Options: None.

Surgery is done when the condition causes problems. Reasons for surgery include: two or more pneumonias on the side of the eventration, one life-threatening pneumonia, inability to get off mechanical ventilation, or respiratory distress related to abnormal motion of the diaphragm.

The operation of choice is called ***diaphragmatic plication***, a procedure which takes the eventration and tightens it with sutures with the goal to flatten the diaphragm muscle. This procedure does not repair the function of the diaphragm. This plication can be performed with open (large incision) or minimal invasive (several small incisions) techniques and can be approached through the chest or abdomen.

Postoperative Care consists of resumption of a normal diet once the child tolerates oral liquids. If the child was on a ventilator before, oral feeding will be delayed until after the breathing tube has been removed. The child may also require pain medicines such as acetaminophen (Tylenol), ibuprofen (Motrin), or narcotics. These medicines can be given by vein or by mouth.

Home Care - "What do I need to do once my child goes home?"

Patients with are usually discharged within 3-7 days depending on the approach.
Diet: Your child may eat a normal diet after discharge.

Activity: Your child should avoid strenuous activity and heavy lifting for the first 1-2 weeks after minimally invasive surgery, 4-6 weeks after open surgery. If the patient is a baby, make sure you check with the surgeon when tummy time can re-start.

Wound care: Surgical incisions should be kept clean and dry for a few days after surgery. The stitches used in children are absorbable and do not require removal. Your surgeon will give you specific guidance regarding wound care, including when your child can shower or bathe.

Medicines: Medicines for pain such as acetaminophen (Tylenol) or ibuprofen (Motrin or Advil) or something stronger like a narcotic may be needed to help with pain for a few days after surgery. Stool softeners and laxatives are needed to help regular stooling after surgery, especially if narcotics are still needed for pain.

What to call the doctor for: Call your doctor for worsening belly pain or chest pain, fever, vomiting, problems with breathing, or if the wounds are red or draining fluid.

Follow-up care: Your child should follow up with his or her surgeon 2-3 weeks after surgery to ensure proper postoperative healing.

Long Term Outcomes - "Are there future conditions to worry about?"

For severely symptomatic patients who were on the ventilator before surgery, diaphragmatic plication can help come off mechanical ventilator support. After surgical treatment, the long-term prognosis is very good.

Updated 10/2021
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