

THE DIAPHRAGMATIC HERNIA: When the chest and abdomen cohabitate



Synopsis-- Anatomy and the Disease

Pretty basic in concept, the diaphragm normally divides the two cavities (thorax and abdomen.) That barrier allows optimal negative pressure in the thorax and prevents space-occupying organs from encroaching on pulmonary mechanics.

It gets a little more nuanced when talking about the different kinds of diaphragmatic hernias. **AN ACUTE/TRAUMATIC CASE** is often over-shadowed by primary pulmonary and chest wall trauma that in, and of itself, compromises ventilation profoundly; the loss of ventilatory efficiency the diaphragm offers may be the *coup de grâce* (or ironically, the anesthesia to correct the D.hernia may be that final blow.)

THE CHRONIC/TRAUMATIC CASE makes us humble since the patient has come this far with “all of that!” in his/her chest and no one’s the wiser...until now. The challenges of this case are loss of domain in the abdomen (with resultant peritoneal hypertension upon closure), adhesions and malpositioned liver/stomach/spleen (resulting in portal hypertension upon relocation into abdomen), and pulmonary collapse/atelectasis (with the potential for re-expansion pulmonary edema).

And finally, **THE NON-TRAUMATIC PERITONEAL-PERICARDIAL DIAPHRAGMATIC HERNIA** often found in cats and some dog breeds at very young or very advanced years of age. To cut or not to cut is often a difficult decision, with postoperative concerns centered around re-expansion pulmonary injury and underappreciated pre-existing cardiac disease/malformation.

Surgical Overview:

Typically, the diaphragmatic hernia is approached via a cranial abdominal approach. ***The coordination between induction of anesthesia and surgical approach must be a well-choreographed event.*** Pre-oxygenation is essential to give us those extra 3-5 minutes of hyperoxygenated tissues that bridge us between spontaneous awake ventilation and mechanical anesthetized ventilation. The surgical room must be set up and surgeon prepped awaiting the patient, prior to induction. Immediate mechanical ventilation upon intubation must be initiated. Pulse oximetry will often demonstrate a significant V-Q mismatch secondary to the degree of pulmonary collapse (getting perfused but not ventilated); the numbers will look crappy.

Rapid prep and transfer to surgical table, allows the surgeon to do a rapid approach and immediate removal of the space-occupying organs in the pleural cavity. Ventilation will improve incrementally thereafter. Mechanical ventilation is maintained until the diaphragm is closed and evacuated to negative pressure, then weaned.

Surgery is a process of repositioning, debriding unnecessary adhesions, massaging/encouraging slow re-expansion of lung tissue, debriding and closing the diaphragmatic rent, evacuating the chest and closing the reestablished abdomen.

The **indications & rationale** for surgical treatment are:

- Acute/traumatic hernias should be surgically corrected *as soon as feasible when other severe respiratory compromising conditions are stabilized* (contusions, rib fractures, etc.) Gastric herniation can turn into an escalating respiratory crisis if/when gastric air further impinges on lungs.
- Chronic/traumatic hernias are non-emergent. Surgical correction should be *scheduled when condition is diagnosed, patient is compromised but stable* and other serious post-traumatic injuries are ruled-out or

addressed. The healing process of fibrous contraction can worsen a patient's condition over weeks-months through vascular strangulation, impinged organ effusion, GI entrapment and distension.

- Peritoneal-pericardial hernias are *non-emergent*, generally. Treatment timing and decision-making are similar to chronic traumatic hernias, although advanced geriatric cases are difficult to prognosticate. It is likely the condition will shorten a patient's lifespan, but surgical risks are significant too.

Other options for treatment are:

- Surgery is the only corrective treatment available.
- Benign neglect is an option in stable, non-clinical patients; the caveat being that they may not remain stable, and ***acutely decompensating previously stable chronic cases are likely poorer surgical candidates than a stable chronic case.***

Supportive/ancillary options with surgical treatment are:

- Temporary postoperative oxygen therapy may be necessary for oxygen-dependent patients upon completion of surgery.
- Medical management of postoperative pulmonary edema may be necessary
- Aggressive pain management is necessary to optimize spontaneous ventilation (i.e. they breathe better on their own when it doesn't hurt to take a deep breath.)
- Acute, severe postoperative portal hypertension or peritoneal hypertension may necessitate emergent reoperation to relieve pressures.
- Untenable intraoperative portal hypertension or peritoneal hypertension may necessitate staged abdominal closure (i.e. 2-3 surgical episodes over 2-3days).

The **perioperative experience** for pet and owner includes:

- Depending on cause and duration, the pet may be admitted after acute trauma and remain hospitalized (or transferred to 24hr facility) for urgent/emergent surgery.
- For all cases, postoperative transfer to 24hr facility may be necessary for poorly performing patients; owners must be aware and available for transfer and additional costs.
- The patient will have some degree of respiratory compromise for 1-2months after surgical correction; activity restrictions and expectations should be limited accordingly.

Expectations for outcome are:

- For surviving patients, longterm outcome is good/normal for return to function.
- For the acute/trauma patients and immediate postoperative patients, respiratory function may be strongly compromised and life-threatening.

Complications that may arise with this procedure are:

- Cardiopulmonary arrest and death.
- Portal hypertension or peritoneal hypertension.
- Unsalvageable organ damage from strangulation may require resection (GI, liver, spleen, lung)
- Painful recovery

Postoperative **outcomes may be poor** due to the above complications, and/or:

- Pulmonary bullae (from original trauma or re-expansion injury) with resultant persistent pneumothorax (rare)
- Recurrent diaphragmatic hernia (rare)

What a surgeon needs prior to surgery:

- Skin near the surgery site CLEAR of infection (papules, pustules, crusts, collarettes, etc.) If urgent surgery, owner must be alerted to *increased risk* of incisional, deep and/or implant infections.
- Owner clearly informed of complications and potential need for postoperative 24hr support or additional procedures.

General considerations and complications for all surgery/anesthesia procedures are:

- *Difficult and/or painful anesthetic recovery (variable; may require additional medications or re-hospitalization)*
- *Incisional infections (rare, minor; usually require oral antibiotics)*
- *Incisional dehiscence (rare, minor or major; may require surgical revision)*
- *Adverse anesthetic event (rare, major; may result in serious impairment or death)*

Proper owner expectations are important to a successful experience and patient outcomes. Please discuss this information with your clients while assisting them with decision-making for **Diaphragmatic hernia repair**.

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