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Video Assisted Thoracoscopic Surgery for Eventeration of Diaphragm- Lessons Learnt

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ABSTRACT

Diaphragmatic eventeration is a developmental defect, attributed to abnormal myoblast migration of the septum transversus and the pleuroperitoneal membrane of the muscular portion of the diaphragm. It appears attenuated and membranous, maintaining its normal attachments and anatomical continuity. Most adult patients are asymptomatic and the diagnosis is an incidental finding. Surgery is indicated only if the patient is symptomatic after a fair trial by conservative methods has failed. We present our lessons learnt from our first 2 cases whom we operated by VATS, not to repeat them again.

KEYWORDS Diaphragm, eventeration, surgery, lessons learnt, VATS.

INTRODUCTION

Diaphragmatic eventeration is a developmental defect of the muscular portion of the diaphragm in which there is an abnormal myoblast migration of the septum transversus and the pleuroperitoneal membrane. It maintains its normal attachments to the skeletal structures. Eventeration leads to diaphragmatic elevation and cephalad displacement of the underlying abdominal viscera. (1-4).

True eventeration can be differentiated from diaphragmatic paralysis, which is more common, by the absence of the muscular layer. In paralysis, the diaphragmatic elevation results from abnormalities of the neuromuscular axis between the spinal cord and diaphragm. The phrenic nerve palsy can occur because of trauma, compression, infectious disease or malignancy.

Depending on the extent of muscle layer deprivation, there is less effective caudal movement of the diaphragm during inspiration. This leads to reduction in lung volume and impaired ventilation. Most adult patients are asymptomatic, and the diagnosis is incidental. Amongst the symptoms, dyspnoea is the commonest .Orthopnoea when lying down is associated with hypoxaemia and respiratory alkalosis.

Palpitations may occur due to supraventricular arrhythmias. Gastrointestinal symptoms include epigastric discomfort, heartburn, bloating, constipation and inability to gain weight. Obesity, pregnancy and strenuous exercise exaggerate the symptoms. (5)... Gastric rupture, volvulus of stomach and splenic flexure of colon have also been reported.(6-7).

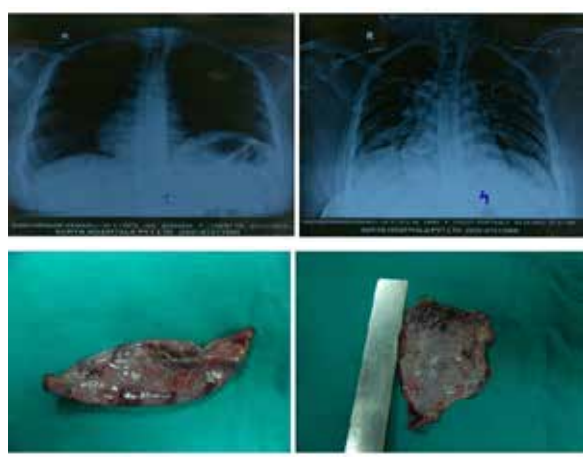
A fair trial is given by conservative method and when it fails surgery is indicated (2-4). The aim of surgery is to maintain a caudal displacement of the diaphragm.

OUR EXPERIENCE IN A COUPLE OF CASES

CASE 1

36 yr old obese female patient weighing 80 kg was referred by a chest physician for repair of left sided eventeration of diaphragm. It was present for 2 years and patient had persistent upper or lower respiratory infection on continuous medication.

Patient was subjected to VATS. The affected hemidiaphragm showed marked thinning and extended upto the left hilum of lung. It was freely mobile and devoid of adhesions. Using green cartridge the redundant atrophic diaphragm was excised and stapled, from the posterolateral costophrenic angle, to the cardiophrenic angle anteriorly and medially. No additional reinforcement was done. Additional diagnostic abdominal laparoscopy was done to rule out injury to abdominal organs. The excised diaphragm was roughly 30-40 sq cm.



(Figure shows the comparative radiographs and the excised diaphragm.)

Patient was settled for 74hours post-operative and post-operative radiograph was normal... She had a bout of vomit following which she became breathless. X-Ray revealed the dehiscence of the repair with the abdominal viscera in left chest cavity. Patient underwent emergency abdominal laparatomy. The catastrophe was because the stapled line had given way. The opening was sutured with 2-0 prolene in 2 layers. Patient had an uneventful recovery and 15 month follow-up showed marked improvement in her respiratory status.

CASE 2

29 yr old thin build male was referred by a gastroenterologist for repair of left sided eventeration of diaphragm. Patient had vague abdominal pain, on continuous medication for 3 yrs and the eventeration was diagnosed for 2 years before referral.

Patient was subjected to VATS. In this case the same procedure as in Case 1 was done, and in addition to stapling, the diaphragm was plicated in 2 layers with inner continuous and outer interrupted stitches with 2-0 prolene. Post abdominal

laparoscopy showed that the stitches were very close to the capsule of spleen and fundus of stomach indicating adequate excision of the eventeration. There was no associated abnormality in that region or in the abdomen. The excised segment of diaphragm was roughly 30-40 sq cm...

(Figure shows the eventeration prior to repair. The right side figure shows an adequately repaired eventeration from the abdomen, which also showed no obvious abdominal pathology.)

Patient had an uneventful post-operative period. The abdominal pain continued though the post-operative radiograph showed good result. 8 months later the patients abdominal pain continued as before though X-Ray wise the result was satisfactory... Patient was lost to follow-up thereafter.

LESSONS LEARNT

From the first case it was obvious that stapling alone is NOT ENOUGH. It has to supplement with plication. The burst strength of staples is not sufficient to withstand pressure from vomiting or straining. The surgery was justified as patient had improved from her pre-operative respiratory status.

In the second case the excision and repair of diaphragm looked satisfactory on the operative table; The result was unsatisfactory symptom wise, giving food for thought regarding the indication for surgery for alimentary complaints...

DISCUSSION

Diaphragmatic eventeration is a developmental defect of the muscular portion of the diaphragm. It was first reported by John Louis Petit in 1714. (8)

It is an extremely rare entity (incidence <0.05%).It can be unilateral/bilateral, partial/complete. Grossly the affected diaphragm appears membranous and microscopically there are absent muscular fibers.

Most adult patients are asymptomatic. Patients can have respiratory, abdominal or cardiovascular complaints. Results are satisfactory with patients presenting with respiratory compromise complaints. Same cannot be said with those presenting with abdominal complaints. We suggest a psychiatry evaluation before advising surgery. They have to be given a fair trial with conservative treatment before surgery is advised. Surgery aims at reducing the redundant diaphragmatic surface, lowering the dome. The repair should be strong and sustainable. (9).

The diaphragm can be approached by an open/laparoscopic route either transabdominally/transthoracic (VATS). In 1959, Christensen did it via an open transthoracic approach and the redundant diaphragm was excised and sutured in 3 layers. (10). DiGorgio in 2006 excised the redundant diaphragm and did a 'dual-layer sandwich mesh repair'. In2009 Hori reported the laparoscopic approach using only staplers for repair. In recent reports, diaphragmatic resection is not performed, only placation is performed (10).The mean burst pressure of an unreinforced staple line is 53 mmHg, additional reinforcement with placation increases the burst strength >90mmHg.

The direction of the staple line is the posterior costo-phrenic angle to the cardio-phrenic angle anteriorly, but various other directions have been described. The aim is that the diaphragm should look flattened at the dome and taut at completion. Difficult to avoid overcorrection/undercorrection as highlighted by Leo etal (11).

Groth etal 2010(3) reviewing the literature of 'diaphragm plication for eventeration paralysis' concluded :"Although the short-term outcomes after minimally invasive plication are promising, long-term results have yet to be published". Gazala etal (5) .conducted a review in 2012. Thirteen studies, including 161 patients, were analyzed who underwent open transthoracic or VATS approach showed similar complication rates.

The VATS group showed early recovery. The thoracoscopic approach have more advantages, regarding objective and subjective measures which includes pulmonary function tests, dyspnoea scores, length of hospitalization and post-operative complications. Study regarding results for cardiovascular and abdominal complaints is not adequate and most studies are retrospective.

CONCLUSION

Ideal treatment for eventeration of diaphragm in an adult is still a dilemma. Those with gross respiratory dysfunction have a good outcome which cannot be said with those presenting with cardiovascular or alimentary symptoms. Stapling alone is not enough when removing the redundant diaphragm and has to be re-inforced. Excision/only or plication of the diseased diaphragm is still debatable. VATS surgery is preferred whenever surgery is advised. Long term results show recurrence of symptoms and further evaluation is necessary before advising surgery.

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