Laparoscopic Diaphragm Plication

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No Disclosures
Diaphragmatic Plication

Eventration - congenital
Paralysis - acquired
Symptomatic
Dyspnea
Orthopnea
Traditional Approach: Open Transthoracic Plication
Open Plication Results

Improved PFTs

Improved quality-of-life

Durable

Higgs Eur J Cardiothorac Surg 2002
Simansky Thorax 2002
Verseegth Eur J Cardiothorac Surg 2007

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Problems with Open Plication

Invasive

Post-thoracotomy pain

Single-lung ventilation
Alternatives to Thoracotomy?
## VATS Plication

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<tbody>
<tr>
<td>FVC</td>
<td>+17.0%</td>
<td></td>
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<tr>
<td>FEV1</td>
<td>+21.4%</td>
<td></td>
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<tr>
<td>TLC</td>
<td>+16.1%</td>
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<tr>
<td>Dyspnea Score</td>
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- **n = 22**
- **Follow-up = 6 mo**

Freeman, Ann Thorac Surg 2006
Problems with VATS

Requires single-lung ventilation

Limited space
Laparoscopic Plication
2005: The Real Story
2005: Setting the Record Straight
Laparoscopic Plication

3 patients

Follow-up: 40-84 months

PFTs improved

Symptom-free

Huttl, Surg Endosc 2004
Advantages

No intercostal nerve pain

Avoid single-lung ventilation

Better visualization

Ample working space
Technical Details
Surgical Technique

• Single lumen ET tube

• Both arms out

• Steep reverse Trendelenberg

• Foot board
Surgical Technique

- T-shaped plication
  #2 Ticron U-stitches
  Pledgets, 31mm needle

- Posterior-Anterior

- Medial-Lateral

- Chest drain
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Groth et al, JTCVS 2010
12 mm Port Placement

Right-Sided Plication
Right-Sided Plication

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Diaphragmatic Hole
Diaphragmatic Hole
Chest Tube
Diaphragmatic Retraction
Diaphragmatic Retraction
Diaphragmatic Retraction
Diaphragmatic Retraction
Diaphragmatic Retraction
Posterior to Anterior Plication
Plication Tip #1

If it is not hard to place the posterior stitch, you are not posterior enough!
#2 Ticron, 31 mm Needle
Posterior to Anterior Plication
Posterior to Anterior Plication
Posterior to Anterior Plication
Load Pledget
Seat Pledget
Square Knot
Seat Square Knot
Intracorporeal Tie
Intracorpororeal Tie (6-8 Knots)
Intracorporeal Tie (6-8 Knots)
Plication Tip #2

After your first posterior suture you need to place 2 or 3 more
Posterior to Anterior Plication
Posterior to Anterior Plication
Medial to Lateral Plication
Medial to Lateral Plication
Completed Plication
Completed Plication

DIAPHRAGM: LATERAL PLICATION
Plication Tip #3

How tight is tight enough?
Post-op Plication Tip

Chest tube until output < 200 cc for 72 hrs

10% home with chest tube

No lifting > 20 lbs x 3 months
Left-Sided Plication

Pre-op

Immediate Post-op

1 month Post-op
Left-Sided Plication

1 month Post-op

12 months Post-op
Right-Sided Plication

Pre-op

Post-op

1 month Post-op

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Plication Tip #4

If BMI > 35, don’t try laparoscopic approach
Plication Tip #5

*Do the left side for your first several cases*
Purpose

Objective short- and mid-term evaluation of laparoscopic plication

Groth, JTCVS 2010

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Methods

Prospective cohort study

4/1/2005 - 8/31/2008

PFTs: preop, postop (1 mo and 12 mo)

SGRQ: preop, postop (1 mo and 12 mo)

Groth, JTCVS 2010

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Inclusion Criteria

Dyspnea and/or orthopnea

Elevated hemidiaphragm

No alternative etiology

Groth, JTCVS 2010

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Exclusion Criteria

Neuromuscular disorders
 Patients

25 patients
– 16 left-sided
– 9 right-sided

Groth, JTCVS 2010
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Morbidity and Mortality

No deaths

Conversion (1)

Complications
  – Pleural effusions (2)
  – Upper GI hemorrhage (1)
  – CVA (1)
  – UTI (1)
  – A-fib (1)
  – Reintubation (1)

Groth, JTCVS 2010

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# Results

<table>
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<tr>
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<th>Median</th>
<th>Range</th>
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<tbody>
<tr>
<td>Chest Tube Duration (Days)</td>
<td>1</td>
<td>0 to 20</td>
</tr>
<tr>
<td>LOS (Days)</td>
<td>4</td>
<td>1 to 11</td>
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Groth, JTCVS 2010

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FEV1% changes over time:

- Pre
- 1 month
- 12 months

Statistical significance:
- p < 0.0001
- p = 0.004

Groth, JTCVS 2010
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**FIF\textsubscript{MAX}**

![Bar chart](image)

- **Pre**: 
- **1 mo**: \(p = 0.003\)
- **12 mo**: \(p = 0.01\)

*Groth, JTCVS 2010*
SGRQ Symptom Score
Perception of Respiratory Difficulties

Groth, JTCVS 2010
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SGRQ Activity Score
Disturbance of Daily Physical Activities

p = 0.003
p = 0.04

Groth, JTCVS 2010
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SGRQ Impacts Score

Disturbance of Psycho-Social Function

![Graph showing SGRQ Impacts Score over time with p-values](image)

- Pre: p < 0.001
- 1 mo: p = 0.002

Groth, JTCVS 2010

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SGRQ Total Score

Groth, JTCVS 2010

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Conclusions

Laparoscopic diaphragmatic plication: novel, minimally invasive, safe

Objective improvement:
– PFTs
– Respiratory quality-of-life

Circumvents disadvantages of transthoracic approaches