

Submission ID #: 72031

Scriptwriter Name: Pallavi Sharma

Project Page Link: https://review.jove.com/files_upload.php?src=21969503

Title: Approach to Robotic, Transabdominal, Left Hemi-Diaphragm Plication

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Author Questionnaire

1. We have marked your project as author-provided footage, meaning you film the video yourself and provide JoVE with the footage to edit. JoVE will not send the videographer. Please confirm that this is correct.

✓ Correct

2. Interview statements: Which interview statement filming option is the most appropriate for your group? **Please select one.**



Interview Statements are read by JoVE's voiceover talent.

3. Proposed interview filming date: Please indicate the proposed date that your group will self-film interviews:

When you are ready to submit your video files, please contact our Content Manager, [Utkarsh Khare](#).

Current Protocol Length

Number of Steps: 06

Number of Shots: 12

Interviews

NOTE to VO: Please record the interview and conclusion statements

INTRODUCTION:

REQUIRED: Summarize your research focus and the main questions it aims to answer.

- 1.1. This research looks at an alternative approach to diaphragm plication and 3 key operative components to ensure successful results.

- 1.1.1. [2.1.1](#)

~~Describe the research gap or limitation in existing methods and how this protocol addresses them.~~

- 1.2. Existing approaches are limited by intrathoracic adhesions or intolerance to single-lung ventilation; this protocol provides an alternative transabdominal diaphragm plication technique.

- 1.2.1. [2.3.1](#)

CONCLUSION:

~~What does this protocol allow researchers to study or measure?~~

- 1.3. This protocol enables surgeons to reproducibly perform and evaluate transabdominal diaphragm plication, including those unfamiliar with the technique.

- 1.3.1. [2.5.2](#)

~~Describe the most important consideration or challenge when performing this protocol.~~

- 1.4. A key consideration while performing this protocol is creating an iatrogenic defect to ensure diaphragmatic laxity and facilitate manipulation, followed by a reinforced two-layer repair.

- 1.4.1. [2.4.2](#)

~~Are there any additional methods or analyses that can be performed following this procedure?~~

- 1.5. Additional analyses may compare outcomes between transabdominal and transthoracic diaphragm plication in matched cohorts and assess procedural modifications based on surgeons' experience.

1.5.1. [2.6.1.](#)

Ethics Title Card

As per the University of Minnesota Institutional Review Board guidelines, this project is categorized as Not Human Subjects Research (NHSR). All data was presented in a completely anonymized and de-identified format, ensuring no direct or indirect tracking of human subjects. All ethical protocols for data handling and privacy were strictly observed.

Protocol

NOTE: The script is drafted using the provided footage

2. Robotic Diaphragm Repair

Demonstrator: Madhuri Rao

2.1. After draping the patient and docking the ports, identify a suitable location in the diaphragm's dome to incorporate into the final plication line. Using bipolar forceps, create an approximately 1 to 2 centimeter opening in the diaphragm with electrocautery using a coagulation setting of 8 until the intra-thoracic cavity is visualized [1].

2.1.1. LAB MEDIA: Original video_12Nov2025.mp4: 04:55-05:08.

2.2. Create a pleat with the redundant diaphragm tissue to establish a plication line along the posterior axis [1]. Using a number 0 non-absorbable, knotless, barbed suture, approximate and tighten the diaphragm in a running, locking manner from the anterior to the posterior aspect of the diaphragm [2].

2.2.1. LAB MEDIA: Original video_12Nov2025.mp4: 08:05-08:15, 08:57-09:00

2.2.2. LAB MEDIA: Original video_12Nov2025.mp4: 11:55-12:10

2.3. Next, use a number 2 Ti-Cron pledgeted suture to reinforce the plication line with interrupted horizontal mattress sutures placed at 1-to-2-centimeter intervals [1]. Continue placing reinforcing sutures as needed, based on the length of the plication line [2].

2.3.1. LAB MEDIA: Original video_12Nov2025.mp4: 24:00-24:05, 25:30-25:50

2.3.2. LAB MEDIA: Original video_12Nov2025.mp4: 40:35-40:45.

2.4. With a non-absorbable, knotless, barbed suture, create the anterior diaphragm plication along a vertical axis. Reinforce the plication line with number 2 pledgeted non-absorbable polyester sutures [1]. Incorporate the diaphragmatic defect created earlier into the plication line to ensure complete closure of the defect [2].

2.4.1. LAB MEDIA: Original video_12Nov2025.mp4: 55:32-55:35, 56:40-57:00 and 01:04:51(still shot)

2.4.2. LAB MEDIA: Original video_12Nov2025.mp4: 01:14:20:01:15:15

2.5. Assess the tautness of the diaphragm along the plication line. Then, reduce the abdominal insufflation pressure to 8 millimeters of mercury [1]. Tap the diaphragm along the plication line with a grasper to confirm that it does not pull away from the costal margin and place additional reinforcing sutures in any areas of residual laxity if needed [2].

2.5.1. LAB MEDIA: Original video_12Nov2025.mp4: 01:35:40-01:35:45

2.5.2. LAB MEDIA: Original video_12Nov2025.mp4: 1:40:26-1:41:50

2.6. Once the plication is complete, assess the posterior and anterior plication lines through the thoracic port [1]. Confirm that the lung tissue is free and that the repair has been completed adequately, with particular attention to the posterior aspect [2].

2.6.1. LAB MEDIA: Original video_12Nov2025.mp4: 01:47:54-01:48:00

2.6.2. LAB MEDIA: Original video_12Nov2025.mp4: 01:48:03-01:48:10

Video editor: Provide the following information using a title card

- Insert a 19 French silicone chest drain through the thoracic port to manage residual pneumothorax and drain postoperative pleural effusion
- Remove the chest tube after lung re-expansion
- Encourage pulmonary hygiene and incentive spirometry
- Provide multimodal pain control and early mobilization
- Confirm repair with chest radiographs before discharge
- Assess repair at 1 month and 1 year with chest radiographs and pulmonary function tests

Results

3. Results

3.1. During the postoperative period, tube thoracostomy remained in place due to the presence of a small air leak and a small left-sided pleural effusion [1].

3.1.1. LAB MEDIA: Figure 9. *Video editor: Highlight the left side of the chest!*

3.2. The air leak self-resolved, and the pleural effusion slowly improved but was still present by the time of tube thoracostomy removal on post-operative day 3 [1].

3.2.1. LAB MEDIA: Figure 10.

3.3. At 1-month follow-up, the two-view chest radiographs demonstrated a very small, left-sided, residual pleural effusion, but the plicated, left hemidiaphragm remained in an appropriate position [1].

3.3.1. LAB MEDIA: Figure 11. *Video editor: Please see the update section on Monday for highlighting information*

1. Diaphragm

Pronunciation link: <https://www.merriam-webster.com/dictionary/diaphragm>

IPA: /'daɪəˌfræm/

Phonetic Spelling: DYE·uh·fram

2. Plication

Pronunciation link: <https://www.merriam-webster.com/medical/plication>

IPA: /plaiˈkeɪʃən/

Phonetic Spelling: ply·KAY·shuhn

3. Bipolar

Pronunciation link: <https://www.merriam-webster.com/dictionary/bipolar>

IPA: /baɪˈpɒlər/

Phonetic Spelling: bye·POH·ler

4. Electrocautery

Pronunciation link: <https://www.merriam-webster.com/medical/electrocautery>

IPA: /ɪˌlektroʊˈkɔːtəri/

Phonetic Spelling: ih·lek·troh·KAW·tuh·ree

5. Coagulation
Pronunciation link: <https://www.merriam-webster.com/dictionary/coagulation>
IPA: /koʊ, ægʒəˈleɪʃən/
Phonetic Spelling: koh-ag-yuh-LAY-shuhn
6. Intrathoracic
Pronunciation link: <https://www.merriam-webster.com/medical/intrathoracic>
IPA: /ˌɪntrəθəˈræsɪk/
Phonetic Spelling: in-truh-thuh-RAS-ik
7. Pleat
Pronunciation link: <https://www.merriam-webster.com/dictionary/pleat>
IPA: /ˈpli:t/
Phonetic Spelling: PLEET
8. Non-absorbable
Pronunciation link: No confirmed link found
IPA: /ˌnɑːnəbˈzɔːrbəbəl/
Phonetic Spelling: non-ub-ZOR-buh-buhl
9. Suture
Pronunciation link: <https://www.merriam-webster.com/dictionary/suture>
IPA: /ˈsuːtʃər/
Phonetic Spelling: SOO-cher
10. Pledged
Pronunciation link: No confirmed link found
IPA: /ˈplɛdʒɪd/
Phonetic Spelling: PLEJ-ih-tid
11. Ti-Cron
Pronunciation link: No confirmed link found
IPA: /ˈtaɪ, krɑːn/
Phonetic Spelling: TYE-kron
12. Polyester
Pronunciation link: <https://www.merriam-webster.com/dictionary/polyester>
IPA: /ˌpɑːliˈɛstər/
Phonetic Spelling: pol-ee-ES-ter
13. Diaphragmatic
Pronunciation link: <https://www.merriam-webster.com/dictionary/diaphragmatic>
IPA: /ˌdaɪəfrægˈmætɪk/
Phonetic Spelling: dye-uh-frag-MAT-ik
14. Insufflation
Pronunciation link: <https://www.merriam-webster.com/medical/insufflation>
IPA: /ˌɪnsəˈfleɪʃən/
Phonetic Spelling: in-suh-FLAY-shuhn
15. Costal
Pronunciation link: <https://www.merriam-webster.com/dictionary/costal>
IPA: /ˈkɑːstəl/
Phonetic Spelling: KOS-tuhl
16. Laxity
Pronunciation link: <https://www.merriam-webster.com/dictionary/laxity>

- IPA: /'læksəti/
Phonetic Spelling: LAK·suh·tee
17. Thoracic
Pronunciation link: <https://www.merriam-webster.com/dictionary/thoracic>
IPA: /θə'ræsɪk/
Phonetic Spelling: tuh·RAS·ik
18. Pneumothorax
Pronunciation link: <https://www.merriam-webster.com/dictionary/pneumothorax>
IPA: /,nu:məθ'θɔ:ræks/
Phonetic Spelling: noo·moh·THOR·aks
19. Pleural
Pronunciation link: <https://www.merriam-webster.com/dictionary/pleural>
IPA: /'plʊrəl/
Phonetic Spelling: PLOOR·uhl
20. Effusion
Pronunciation link: <https://www.merriam-webster.com/dictionary/effusion>
IPA: /ɪ'fju:ʒən/
Phonetic Spelling: ih·FYOO·zhuhn
21. Spirometry
Pronunciation link: <https://www.merriam-webster.com/medical/spirometry>
IPA: /spə'rɑ:mətri/
Phonetic Spelling: spy·ROM·uh·tree
22. Multimodal
Pronunciation link: <https://www.merriam-webster.com/dictionary/multimodal>
IPA: /,mʌlti'moʊdəl/
Phonetic Spelling: mul·tee·MOH·duhl
23. Mobilization
Pronunciation link: <https://www.merriam-webster.com/dictionary/mobilization>
IPA: /,moʊbələ'zeɪʒən/
Phonetic Spelling: moh·buh·luh·ZAY·shuhn
24. Radiographs
Pronunciation link: <https://www.merriam-webster.com/dictionary/radiograph>
IPA: /'reɪdiə,græfs/
Phonetic Spelling: RAY·dee·uh·grafs
25. Thoracostomy
Pronunciation link: <https://www.merriam-webster.com/medical/thoracostomy>
IPA: /θɔ:rə'kɔ:stəmi/
Phonetic Spelling: thor·uh·KOS·tuh·mee
26. Hemidiaphragm
Pronunciation link: No confirmed link found
IPA: /,hɛmi'daɪə,fræm/
Phonetic Spelling: hem·ee·DYE·uh·fram