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Title: A Translational Surgical Porcine Model for Postoperative Intra-Abdominal Adhesion Formation

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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: **N/A**

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

Current Protocol Length

Number of Steps: 07

Number of Shots: 14

Introduction

NOTE TO VO: Please record this section

INTRODUCTION:

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

- 1.1. This study developed a clinically relevant porcine model of postoperative intraabdominal adhesions to study adhesion biology and test anti-adhesion therapies.

1.1.1. *Suggested B.roll: 3.1.1*

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

- 1.2. While rodent models provide valuable insights, this protocol more closely replicates human abdominal surgery and reliably produces clinically relevant adhesions.

1.2.1. *Suggested B.roll: 3.1.2*

CONCLUSION:

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

- 1.3. This protocol allows researchers to study adhesion biology, fibrosis development, and test potential therapies to prevent postoperative adhesions.

1.3.1. *Suggested B.roll: 2.5*

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

- 1.4. The most important consideration is performing standardized peritoneal injury and bowel surgery to ensure consistent and reproducible adhesion formation.

1.4.1. *Suggested B.roll: 2.7.1*

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

- 1.5. Researchers can perform gross and histologic adhesion scoring and harvest tissues for downstream molecular, cellular, and fibrosis analyses.

1.5.1. *Suggested B.roll: 2.7.2*

Ethics Title Card

This research has been approved by the Institutional Animal Care and Use Committee (IACUC) at the Stanford University

Protocol

NOTE: Post-shoot was finalized from the draft since authors wanted VO to record the interviews

2. Porcine Model of Small Bowel Resection, Anastomosis, and Adhesion Assessment

Demonstrator: Deshka Foster

2.1. To begin, drape the abdomen of an anesthetized pig using sterile towels and surgical drapes to maintain sterility throughout the procedure [1].

2.1.1. LAB MEDIA: 3.3_Sterile_Draping.mp4 00:00 – 00:26

2.2. Perform a midline laparotomy by making a full-thickness incision through the skin, subcutaneous tissue, and abdominal wall musculature along the linea alba to enter the peritoneal cavity using a 10-blade scalpel [1]. Eviscerate the intestines [2].

2.2.1. LAB MEDIA: 3.4a_Incision.mp4 00:07 – 00:12

AND

3.4b_Incision_Subcutaneous.mp4 00:04 – 00:20

AND

3.4c_Incision_LinealAlba_Peritoneum.mp4 00:13 – 00:34

2.2.2. LAB MEDIA: 3.4d_Eviscerate.mp4 00:00 – 00:08

2.3. Identify a region of the bowel approximately 10 to 15 centimeters proximal to the ileocecal valve [1] and resect a 2.5-centimeter segment of the small bowel using scissors [2]. Resect the associated mesentery with electrocautery for hemostasis of the mesenteric blood vessels [3].

2.3.1. LAB MEDIA: 3.5a_Bowel_Resection.mp4 00:00 – 00:05

2.3.2. LAB MEDIA: 3.5a_Bowel_Resection.mp4 00:09 – 00:21

2.3.3. LAB MEDIA: 3.5a_Bowel_Resection.mp4 00:23 – 00:39

2.4. Perform a two-layer, side-to-side primary anastomosis [1]. Reconstruct the inner layer of the lumen with a synthetic 3-0 absorbable suture in a running fashion [2] and reconstruct the outer layer with a running 3-0 non-absorbable suture [3].

2.4.1. LAB MEDIA: 3.5b_Enterotomies.mp4 00:17 – 00:26, 00:34-00:40

2.4.2. LAB MEDIA: 3.5c_Anastomosis_Innerlayer.mp4 00:00 – 00:17,

2.4.3. LAB MEDIA: 3.5d_Anastomosis_Outerlayer.mp4 00:04 – 00:16

2.5. Gently abrade a 3 by 5 centimeter section of the parietal peritoneum along the right abdominal sidewall using sterile gauze or an electrocautery scratch pad [1-TXT].

- 2.5.1. LAB MEDIA: 3.6_Abrasion.mp4 00:00 – 00:14
TXT: Abrade until peritoneal surface appears frayed
- 2.6. Close the fascia with a running 0-0 absorbable suture [1]. Close the skin with a running 2-0 or 3-0 non-absorbable suture [2-TXT].
 - 2.6.1. LAB MEDIA: 3.8a_Fascial_Closure.mp4 00:39 – 00:52
 - 2.6.2. LAB MEDIA: 3.8b_Skin_Closure.mp4 00:03 – 00:15
TXT: Cover with sterile dressing
- 2.7. After 4 weeks, assess adhesions grossly [1]. Immediately collect tissues and blood samples for downstream analyses [2].
 - 2.7.1. LAB MEDIA: 5.2a_Adhesion_Assessment.mp4 00:00 – 00:06
 - 2.7.2. LAB MEDIA: 5.2b_Adhesion_Harvest.mp4 00:00 – 00:06

Results

3. Results

- 3.1. Intra-abdominal adhesions formed in 100% of animals evaluated on both the abraded and non-abraded sides of the abdomen [1]. Abraded side adhesions demonstrated significantly higher adhesion scores than the non-abraded side [2].
 - 3.1.1. LAB MEDIA: Figure 2A. *Video editor: Highlight the bars labeled “Bowel to sidewall - Abraded side (Right)” and “Bowel to sidewall adhesion - Unabraded areas.”*
 - 3.1.2. LAB MEDIA: Figure 2A. *Video editor: Highlight the bar for “Bowel to sidewall - Abraded side (Right)” showing the higher value.*
- 3.2. In all animals, adhesions involved multiple abdominal sites, including the small intestine, colon, liver, and parietal peritoneum [1]. Adhesion tissue was carefully dissected and harvested in isolation for downstream analyses [2].
 - 3.2.1. LAB MEDIA: Figure 2B. *Video editor: Highlight the areas pointed at by the white arrows in all images*
 - 3.2.2. LAB MEDIA: Figure 2C.
- 3.3. Histologic evaluation at 4 weeks revealed that adhesions consisted of extracellular matrix dominated by fibroblasts and new blood vessel formation [1].
 - 3.3.1. LAB MEDIA: Figure 3. *Video editor: Highlight the region labeled “Fibroblasts” and “Blood Vessels” in both A and B*

Pronunciation Guide:

Translational

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

IPA: /ˌtrænzˈleɪʃənəl/

Phonetic Spelling: tranz·lay·shuh·nuhl

Porcine

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

IPA: /ˈpɔːrˌsaɪn/, /ˈpɔːrˌsiːn/

Phonetic Spelling: por·syne, por·seen

Postoperative

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

IPA: /ˌpoustˈɑːp(ə)rətɪv/

Phonetic Spelling: pohst·op·er·uh·tiv

Intraabdominal

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

IPA: /ˌɪntrə æbˈdɔːmənəl/

Phonetic Spelling: in·truh ab·dom·uh·nuhl

Adhesion

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

IPA: /ədˈhiːʒən/

Phonetic Spelling: ad·hee·zhuhn

Laparotomy

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

IPA: /ˌləpəˈrɑːtəmi/

Phonetic Spelling: lap·uh·rot·uh·mee

Eviscerate

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

IPA: /iˈvɪsəˌreɪt/

Phonetic Spelling: ee·vis·uh·rayt

Ileocecal

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

IPA: /ˌɪli.oʊˈsiːkəl/

Phonetic Spelling: il·ee·oh·see·kuhl

Mesentery

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

IPA: /ˈmezənˌteri/

Phonetic Spelling: mez·uhn·ter·ee

Electrocautery

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

IPA: /ɪˌlektroʊˈkɔːtəri/

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

Hemostasis

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

IPA: /ˌhiːmoʊˈsteɪsɪs/, /ˌhemoʊˈsteɪsɪs/

Phonetic Spelling: hee·moh·stay·suhs, hem·oh·stay·suhs

📖 Anastomosis

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

IPA: /əˌnæstəˈmoʊsɪs/

Phonetic Spelling: uh·nas·tuh·moh·suhs

📖 Peritoneum

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

IPA: /ˌpɛrɪtəˈniːəm/

Phonetic Spelling: peh·ruh·tuh·nee·uhm

📖 Parietal

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

IPA: /pəˈraɪətəl/

Phonetic Spelling: puh·rye·uh·tl

📖 Fibrosis

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

IPA: /faɪˈbroʊsɪs/

Phonetic Spelling: fye·broh·suhs

📖 Histologic

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

IPA: /ˌhɪstəˈlɑːdʒɪk/

Phonetic Spelling: his·tuh·loj·ik

📖 Extracellular

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

IPA: /ˌɛkstrəˈsɛljələr/

Phonetic Spelling: eks·truh·sel·yuh·ler