Submission ID #: 68418
Scriptwriter Name: Poornima G
Project Page Link: https://review.jove.com/account/file-uploader?src=20867538

Title: Procurement for a Vascularized and Reinnervated Abdominal Wall Allotransplantation

Authors and Affiliations:
Pierre Barbat[1,2], Antoine Sicard[2,3], Yanis Berkane[4], Nicolas Bronsard[5], Olivier Camuzard[1], Elise Lupon[1,2]

[1]Department of Plastic and Reconstructive Surgery, Institut Universitaire Locomoteur et du Sport, Pasteur 2 Hospital, University Côte d'Azur
[2]Laboratory of Molecular PhysioMedicine (LP2M), UMR 7370, CNRS, University Côte d'Azur
[3]Department of Nephrology, Dialysis and Kidney Transplantation, University Hospital of Nice
[4]Department of Plastic, Reconstructive and Aesthetic Surgery, Hospital Sud, University of Rennes 1
[5]Department of orthopeadic Surgery, Institut Universitaire Locomoteur et du Sport, Pasteur 2 Hospital, University Côte d'Azur

Corresponding Authors:
Pierre Barbat pierrebarbat25@gmail.com

Email Addresses for All Authors:
Antoine Sicard sicard.a@chu-nice.fr
Yanis Berkane yanis.berkane@live.fr
Nicolas Bronsard bronsard.n@chu-nice.fr
Olivier Camuzard camuzard.o@chu-nice.fr
Elise Lupon elupon@mgh.harvard.edu
Pierre Barbat pierrebarbat25@gmail.com

Author Questionnaire

1. **Microscopy**: Does your protocol require the use of a dissecting or stereomicroscope for performing a complex dissection, microinjection technique, or something similar? **No**

2. **Software:** Does the part of your protocol being filmed include step-by-step descriptions of software usage? **No**

3. **Filming location:** Will the filming need to take place in multiple locations? **No**

Current Protocol Length
Number of Steps: 25
Number of Shots: 51

Introduction

Videographer: Obtain headshots for all authors available at the filming location.

NOTE: Please add only statements 1.1, 1.2, 1.3, 1.4 and 1.7 in the video.
If any of these statements are not properly rendered, then use the options of 1.5 and 1.6.

1.1. **Elise Lupon :** Our French laboratory is focused on enhancing vascularized composite allografts through improved harvest protocols, optimized graft preservation, and strategies to reduce ischemia-reperfusion injury and induce immune tolerance.

1.1.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera. *Suggested B-roll: 2.3.1*

What are the current experimental challenges?

1.2. **Pierre Barbat :** The main current challenges in allotransplantation include standardizing procurement methods and developing robust, protocolized tissue preservation techniques to ensure graft viability and improve long-term functional and immunological outcomes.

1.2.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera. *Suggested B-roll: 3.3.2*

What research gap are you addressing with your protocol?

1.3. **Pierre Barbat :** This protocol is intended for teams specializing in vascularized composite allografts, to help them perform optimized abdominal allotransplantations in a reliable and reproducible way.

INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera. *Suggested B-roll: 4.2.1*

What advantage does your protocol offer compared to other techniques?

1.4. **Pierre Barbat :** Unlike other techniques, this protocol provides a step-by-step guide to procuring a reinnervated abdominal wall transplant, which is key for optimal functional recovery.

1.4.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera. *Suggested B-roll: 6.3.1*

What technologies are currently used to advance research in your field?

1.5. **Elise Lupon :** Our French reconstructive department focuses on enhancing nerve regeneration—a growing field—using techniques like TMR, RPNI, and nerve conduits. This is especially relevant during the transplantation step of this graft.

1.5.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera. *Suggested B-roll: 4.4.2* **NOTE**: Don't use this in the video, unless needed

What new scientific questions have your results paved the way for?

1.6. **Pierre Barbat :** Our protocol raises key questions about how many nerve repairs are needed—and which techniques to use—to achieve meaningful motor reinnervation and functional recovery.

1.6.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera. *Suggested B-roll: 6.3.3* **NOTE**: Don't use this in the video, unless needed

What research questions will your laboratory focus on in the future?

1.7. **Elise Lupon :** Our laboratory will focus on graft preservation which is a key to a successful transplantation and this protocol could be a very useful model if harvested on a dead brain donor under strict research authorization.

1.7.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera. *Suggested B-roll: 7.1.2*

Videographer: Obtain headshots for all authors available at the filming location.

Ethics Title Card

This research has been approved by the French National Ethics Committee

Protocol

2. Preoperative Drawing for Allotransplantation

Demonstrator: Pierre Barbat

2.1. To begin, position the patient supine on the surgical table, with the arms alongside the body **[1]**. Use a dermographic pencil to draw the superior boundary line starting at the xiphoid process of the sternum **[2]**. Extend this line laterally, tracing the inferior margin of the rib cage on both sides until it reaches a vertical line situated 2 to 3 centimeters lateral to the anterior superior iliac spine **[3]**.

2.1.1. WIDE: Talent assisting the patient to take the supine position on the surgical table.

2.1.2. Talent using a dermographic pencil to mark the line starting at the xiphoid process of the sternum.

2.1.3. Shot of the drawn line tracing the inferior margin of the rib cage on both sides.

2.2. Define the lateral boundary with a vertical line positioned 2 to 3 centimeters lateral to the anterior superior iliac spine **[1]**. From this point, draw a downward line to reach the femoral artery pulse, located approximately 7 to 10 centimeters below the inguinal ligament **[2]**.

2.2.1. Talent locating and marking the vertical line lateral to the anterior superior iliac spine.

2.2.2. Talent drawing a line downward toward the femoral artery pulse.

2.3. Next, draw the inferior boundary by extending a line from the femoral artery pulse toward the pubic spine on each side **[1]**. Connect both sides of the drawing along the midline, ending at the pubic symphysis to complete the triangular outline **[2]**.

2.3.1. Talent drawing lines from the femoral artery pulse toward the pubic spine on both sides.

2.3.2. Talent connecting the two lines along the midline toward the pubic symphysis.

3. Making the Upper Incisions

3.1. Perform a bilateral subcostal skin incision along the previously marked line using a cold scalpel blade **[1]**.

3.1.1. Talent using a scalpel to make a bilateral subcostal skin incision along the marked line.

3.2. Then, using an electrocautery device, incise through the subcutaneous tissue until reaching the muscular fascia **[1]**.

3.2.1. Talent using an electrocautery to dissect through subcutaneous tissue down to the muscular fascia.

3.3. Incise the fascia overlying the rectus abdominis muscles to expose the underlying muscle bodies **[1]** and transect the costal insertions of the rectus abdominis muscles with the electrocautery device **[2]**.

3.3.1. Talent incising the fascia to reveal the rectus abdominis muscles. **NOTE**: file DSC_9059 is 3.3.1

3.3.2. Talent using electrocautery to transect the costal insertions of the rectus abdominis.

3.4. Now, identify the superior epigastric vessels behind the rectus muscles **[1]**, ligate them carefully **[2]**, and section them with the electrocautery **[3]**.

3.4.1. Talent pointing to the superior epigastric vessels.

3.4.2. Talent ligating the superior epigastric vessels.

3.4.3. Talent cutting the ligated vessels with electrocautery.

3.5. Behind each mobilized rectus muscle, incise the deep muscular aponeurosis **[1]**, then the transversalis fascia **[2]**, and finally the parietal peritoneal fascia **[3]**.

3.5.1. Talent cutting the deep muscular aponeurosis.

3.5.2. Talent incising the transversalis fascia.

3.5.3. Talent opening the parietal peritoneal fascia.

3.6. Laterally, dissect the external oblique muscles to expose and identify the semilunar line **[1]**.

3.6.1. Talent dissecting the external oblique muscles and pointing to the semilunar line.

4. Incising Along the Lateral Lines

4.1. Perform a skin incision with a cold scalpel blade following the previously marked lateral boundary **[1]**.

4.1.1. Talent using a cold scalpel blade to make an incision along the lateral boundary.

4.2. Use an electrocautery device to continue the incision through the subcutaneous tissue until the aponeurotic layer of the external oblique muscles is reached **[1]**.

4.2.1. Talent using an electrocautery device to dissect through subcutaneous tissue to expose the aponeurotic layer.

4.3. Next, incise the external oblique muscle, followed by the internal oblique muscle, maintaining a lateral margin of 2 to 3 centimeters from the semilunar line **[1-TXT]**.

4.3.1. Talent sequentially incising the external and internal oblique muscles. **TXT: Avoid injury to the thoracolumbar nerves**

4.4. Then, locate the thoracolumbar nerves between the internal oblique and transverse abdominis muscles **[1]** and carefully dissect these nerves laterally as far as possible to preserve them **[2]**.

4.4.1. Talent pointing to thoracolumbar nerves between muscle layers.

4.4.2. Talent gently dissecting and mobilizing the nerves laterally.

4.5. Once the thoracolumbar nerves are secured, incise the transverse abdominis muscle

[1], followed by the transversalis fascia **[2]**, and then the parietal peritoneal fascia **[3]**.

4.5.1. Talent incising the transverse abdominis muscle.

4.5.2. Talent cutting through the transversalis fascia.

4.5.3. Talent opening the parietal peritoneal fascia.

4.6. While releasing the allograft, identify the deep inferior epigastric pedicles located on the deep surface of the rectus abdominis muscles **[1]**.

4.6.1. Talent pointing to the deep inferior epigastric pedicles on the inner surface of the rectus abdominis muscles.

5. Lower Incision and Pedicle Dissection

5.1. Make a skin incision along the lower design using a cold scalpel blade **[1]**. Using an electric scalpel, continue the dissection through the subcutaneous tissue until reaching the crural muscular aponeurotic plane of the thigh **[2]**.

5.1.1. Talent incising the skin along the lower boundary using a cold scalpel.

5.1.2. Talent dissecting through subcutaneous tissue with an electric scalpel to expose the crural aponeurosis.

5.2. Now, identify the great saphenous vein **[1]**, ligate and transect it **[2]**. Then, locate the lateral femoral cutaneous nerve and transect it **[3]**. Incise the crural fascia, ensuring it is included in the graft specimen **[4]**.

5.2.1. Talent pointing to the great saphenous vein.

5.2.2. Talent ligating and cutting the great saphenous vein.

5.2.3. Talent transecting the lateral femoral cutaneous nerve.

5.2.4. Talent making a full-thickness incision through the crural fascia.

5.3. Next, elevate the two triangular fascio-cutaneous flaps located beneath the inguinal ligaments until the femoral vessels are exposed **[1]**.

5.3.1. Talent lifting both fascio-cutaneous flaps to expose the femoral vessels.

5.4. On both sides, carefully dissect the femoral artery and vein along with their collateral branches, including the superficial inferior epigastric and superficial circumflex iliac vessels **[1]**. Continue the dissection toward the external iliac artery and vein **[2]**, identifying and preserving the deep inferior epigastric and deep circumflex iliac vessels **[3]**. Then, loop the deep inferior epigastric vessels with a silicone loop for protection **[4]**.

5.4.1. Talent dissecting the femoral vessels and their superficial branches.

5.4.2. Talent dissecting toward the external iliac vessels.

5.4.3. Talent pointing to the preserved deep inferior epigastric and circumflex iliac vessels.

5.4.4. Talent looping the deep inferior epigastric vessels with silicone loops.

5.5. To continue the dissection above the inguinal ligament, remove the muscular fascia over the iliac muscle to avoid damaging the deep circumflex iliac vessels **[1]**. Using an electric scalpel, detach the rectus abdominis muscles from their pubic insertions, ensuring the deep inferior epigastric vessels remain intact **[2]**.

5.5.1. Talent carefully removing the fascia over the iliac muscle while preserving underlying vessels.

5.5.2. Talent detaching the rectus abdominis muscles with an electric scalpel while preserving vascular integrity.

5.6. Next, ligate and transect the contents of the inguinal canal including the round ligament of the uterus and ilioinguinal nerve in women **[1-TXT]**.

5.6.1. Talent ligating and transecting the respective structures based on donor sex. **TXT: Remove the spermatic cord and ilioinguinal nerve in men**

5.7. To complete the dissection, ligate and cut the deep circumflex iliac, superficial circumflex iliac, and superficial inferior epigastric vessels at their origins on the external iliac and femoral vessels **[1]**. Ensure the two deep inferior epigastric vascular pedicles remain attached to both the abdominal wall allograft and the donor's body **[2]**.

5.7.1. Talent cutting the specified vessels at their origins.

5.7.2. Talent pointing to the pedicle attachment to the allograft and donor body.

6. Graft Weaning and Conditioning

6.1. After removing the abdominal viscera, identify and mark the deep inferior epigastric vessels on both sides, typically one artery and two veins per side **[1]**. Carefully dissect and ligate these vessels at their origins from the external iliac vessels **[2]** and then transect the vessels to release the graft **[3]**.

6.1.1. Talent identifying and marking the deep inferior epigastric vessels.

6.1.2. Talent dissecting and ligating the vessels.

6.1.3. Talent transecting vessels to release the graft.

6.2. Now, catheterize each deep inferior epigastric artery using a vascular cannula equipped with a stopcock **[1]** and secure it to the arterial lumen with a ligature **[2]**.

6.2.1. Talent inserting cannulas into each deep inferior epigastric artery.

6.2.2. Talent securing the cannula to the arterial lumen with a ligature .

6.3. Finally, attach an irrigation set to the cannulas **[1]** and flush the graft with 1 to 3 liters of University of Wisconsin preservation solution tempered at 4 degrees Celsius **[2]**. Maintain a flow rate of approximately 100 milliliters per minute under low pressure, not exceeding 100 millimeters of mercury, until the effluent runs clear **[3]**.

6.3.1. Talent connecting an irrigation set to the cannula.

6.3.2. Talent initiating the flush with cold preservation solution.

6.3.3. Close-up of effluent becoming clear, indicating proper graft flushing.

Results

7. Results

7.1. The average usable length of the thoracolumbar nerves dissected from both right and left sides was 68 millimeters **[1]**, with individual nerve lengths ranging from 60 to 85 millimeters **[2]**.

7.1.1. LAB MEDIA: Table 1.

7.1.2. LAB MEDIA: Table 1. *Video editor: Highlight the first 8 rows from top*.

7.2. The deep inferior epigastric artery measured 85 millimeters on the left **[1]** and 71 millimeters on the right before entering the graft **[2]**.

7.2.1. LAB MEDIA: Table 1. *Video editor: Highlight the row "Left deep inferior epigastric artery" and their corresponding length of 85*

7.2.2. LAB MEDIA: Table 1. *Video editor: Highlight the row "Right deep inferior epigastric artery" and "71".*

Pronunciation guide

1. Xiphoid Process

- **Pronunciation link**: https://www.merriam-webster.com/dictionary/xiphoid%20process
- **IPA**: /ˈzaɪ.fɔɪd ˈprɑː.ses/
- **Phonetic Spelling**: ZAI-foid PRAH-ses(merriam-webster.com)

2. Anterior Superior Iliac Spine

- **Pronunciation link**: https://www.merriam-webster.com/medical/anterior%20superior%20iliac%20spine
- **IPA**: /ænˈtɪr.i.ɚ suːˈpɪr.i.ɚ ˈɪl.i.æk spaɪn/
- **Phonetic Spelling**: an-TEER-ee-er soo-PEER-ee-er IL-ee-ak spine(merriam-webster.com)

3. Subcostal

- **Pronunciation link**: https://www.merriam-webster.com/medical/subcostal
- **IPA**: /ˌsʌbˈkɑː.stəl/
- **Phonetic Spelling**: sub-KAH-stuhl(merriam-webster.com)

4. Electrocautery

- **Pronunciation link**: https://www.merriam-webster.com/dictionary/electrocautery
- **IPA**: /ɪˌlɛk.troʊˈkɔː.tə.ri/
- **Phonetic Spelling**: ih-LEK-troh-KAW-tuh-ree

5. Rectus Abdominis

- **Pronunciation link**: https://www.merriam-webster.com/medical/rectus%20abdominis
- **IPA**: /ˈrɛk.təs æbˈdɑː.mə.nɪs/
- **Phonetic Spelling**: REK-tuhs ab-DAH-muh-nis(merriam-webster.com, merriam-webster.com)

6. Epigastric

- **Pronunciation link**: https://www.merriam-webster.com/dictionary/epigastric
- **IPA**: /ˌɛp.ɪˈgæs.trɪk/
- **Phonetic Spelling**: EP-ih-GAS-trik

7. Aponeurosis

- **Pronunciation link**: https://www.merriam-webster.com/dictionary/aponeurosis
- **IPA**: /ˌæp.ə.njʊˈroʊ.sɪs/
- **Phonetic Spelling**: AP-uh-nyoo-ROH-sis

8. Transversalis Fascia

- **Pronunciation link**: https://www.merriam-webster.com/medical/transversalis%20fascia
- **IPA**: /ˌtrænz.vəˈseɪ.lɪs ˈfæʃ.i.ə/
- **Phonetic Spelling**: trans-ver-SAY-lis FASH-ee-uh(merriam-webster.com)

9. Semilunar Line

- **Pronunciation link**: https://www.merriam-webster.com/medical/semilunar%20line
- **IPA**: /ˌsɛm.iˈluː.nɑːr laɪn/
- **Phonetic Spelling**: SEM-ee-LOO-nar line(merriam-webster.com)

10. Thoracolumbar

- **Pronunciation link**: https://www.merriam-webster.com/medical/thoracolumbar

- **IPA**: /ˌθɔːr.ə.koʊˈlʌm.bɑːr/
- **Phonetic Spelling**: THOR-uh-koh-LUM-bar

11. Transversus Abdominis

- **Pronunciation link**: https://www.merriam-webster.com/medical/transversus%20abdominis
- **IPA**: /trænzˈvɜːr.səs æbˈdɒ.mɪ.nɪs/
- **Phonetic Spelling**: trans-VER-sus ab-DOM-ih-nis(merriam-webster.com)

12. Crural

- **Pronunciation link**: https://www.merriam-webster.com/dictionary/crural
- **IPA**: /ˈkruː.rəl/
- **Phonetic Spelling**: KROO-ruhl(merriam-webster.com)

13. Saphenous Vein

- **Pronunciation link**: https://www.merriam-webster.com/medical/saphenous%20vein
- **IPA**: /ˈsæf.ə.nəs veɪn/
- **Phonetic Spelling**: SAF-uh-nuhs vein

14. Ilioinguinal

- **Pronunciation link**: https://www.merriam-webster.com/medical/ilioinguinal
- **IPA**: /ˌɪl.i.oʊˈɪŋ.gwɪ.nəl/
- **Phonetic Spelling**: IL-ee-oh-ING-gwih-nuhl

15. Cannula

- **Pronunciation link**: https://www.merriam-webster.com/dictionary/cannula
- **IPA**: /ˈkæn.jə.lə/
- **Phonetic Spelling**: KAN-yuh-luh
