FINAL SCRIPT: APPROVED FOR FILMING

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Title: Upper-Extremity Approach for Secondary Access in Transfemoral Transcatheter Aortic Valve Implantation

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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 computer/software usage? **Yes, all done**

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

Current Protocol Length
Number of Steps: 24
Number of Shots: 43 (5 SC)

Introduction

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

1.1. **Geert Versteeg:** Our goals include refining our TAVI practices and improve overall procedural outcomes. One of our aims was to reduce access site complications and facilitate early mobilization and quick rehabilitation.

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 advantage does your protocol offer compared to other techniques?

1.2. **Geert Versteeg:** Inserting a temporary pacing lead in a manner that allows for early patient mobilization does not only enhance clinical outcomes but also increases satisfaction among both patients and nursing staff.

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

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

1.3. **Geert Versteeg:** Our current goal is to enhance diagnostic accuracy for paravalvular regurgitation. By utilizing invasive hemodynamic measurements and developing a real-time algorithm, we aim to more effectively detect and reduce paravalvular regurgitation.

1.3.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera. *Suggested B-roll: 5.1.1*

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

Ethics Title Card

This research has been approved by the Medical Research Ethics Committee Oost-Nederland and the review boards at each participating site

Protocol

NOTE: Authors have mentioned/requested multiple times that their patient's information that appears in the background monitor/board for certain shots should not be seen in the video (they need to be cropped out or blurred).

Video editor: please watch out for patient information in the footage and **blur them** if they are appearing in the **videographer's footage**.

2. Patient and the Access Site Preparation

Demonstrators: Niels van Royen and Guillaume Geuzebroek

2.1. To begin, instruct the patient to lie in a supine position on the catheterization table **[1]**. Fully extend the patient's left arm at a 90-degree angle relative to the thorax, maintaining the arm in the same vertical plane and support the arm with an armrest**[2]**.

2.1.1. WIDE: Talent guiding the patient to lie on the catheterization table in a supine position.

2.1.2. Talent positioning the patient's left arm on an arm rest at a 90-degree angle, aligned with the thorax. **NOTE**: Action changed

2.2. ~~Then, support the patient's extended arm using an armrest **[1]**~~. Instruct the patient to overextend and supinate the arm to present the medio-ventral side of the upper arm to the operator **[2-TXT]**.

2.2.1. ~~Talent placing an armrest under the patient's extended arm~~. **NOTE**: Shot 2.1.2 covers this shot too and they cannot be separate points as the action happen simultaneously

2.2.2. Talent demonstrating and the patient supinating and overextending the arm to expose the medio-ventral upper arm. **TXT: Additional support of the upper arm might be required**

2.3. Disinfect the entire upper arm using either chlorhexidine or povidone-iodine to prepare the access site **[1]** and wrap a tourniquet around the upper arm as proximally as possible to enhance vein visibility **[2]**.

2.3.1. Talent swabbing the patient's upper arm with disinfectant.

2.3.2. Talent tying a tourniquet high on the upper arm and tightening it to make the veins more visible.

2.4. Place a sterile cover that exposes only the disinfected upper arm to create a sterile field **[1]**. Now, prepare for ultrasound-guided puncture by using a vascular probe, covering it with ultrasound gel and a sterile probe cover, and applying sterile ultrasound gel to the access site **[2]**.

2.4.1. Talent laying down a sterile drape and adjusting it to reveal only the disinfected area of the arm.

2.4.2. Talent fitting a sterile cover over the ultrasound probe and applying ultrasound gel to the patient's upper arm.

3. Access Site Puncture for Upper-Extremity Temporary Pacing Lead Placement

3.1. Use ultrasound to locate a suitable vein for puncture, typically found 5 to 10 centimeters proximal to the elbow crease **[1]**. Identify the basilic vein on the medio-ventral side or the cephalic vein on the lateral side as common choices **[2-TXT]**.

3.1.1. Talent scanning the upper arm with ultrasound to locate veins.

3.1.2. Talent pointing to the ultrasound view showing vein options. **TXT: Alternatively, locate the brachial vein if necessary**

~~3.2. To evaluate the vein's suitability, check for proximity to critical structures that could lead to complications **[1]**. If the vein lies close to an artery, trace the vein proximally or distally to locate a safer puncture site **[2]**.~~

~~3.2.1. Shot of the Ultrasound monitor showing a vein adjacent to an artery and Talent pointing to the same.~~

3.2.2. ~~Shot of the Ultrasound monitor showing vein being followed proximally to find a safer position~~. **NOTE**: Not filmed, VO moved as on-screen text

3.3. Choose a vein based on depth, giving preference to superficial veins and select a vein with a larger diameter for easier puncture **[1-TXT]**. ~~Ensure that the vein's location allows arm flexion without interfering with the pacing lead, avoiding sites too close to the elbow crease **[2]**.~~

3.3.1. Shot of the Ultrasound monitor showing the scan and pointing to a shallow vein
TXT: If the vein is near an artery, follow it to find a safer puncture site

3.3.2. ~~Talent moving ultrasound probe slightly more proximal to the elbow crease~~.
NOTE: Not filmed

3.4. After selecting a suitable vein, use the ultrasound probe to compress it and confirm it is a vein by ensuring it collapses under pressure **[1]**. Infiltrate the subcutaneous tissue at the desired access site with 1 to 2 milliliters of 1 percent lidocaine solution **[2]**.

3.4.1. Talent compressing the vessel, showing vein collapse.

3.4.2. Talent injecting lidocaine at the selected puncture site using a syringe.

3.5. Using direct ultrasound guidance, puncture the vein with a hollow needle from the 6 French sheath kit and confirm backflow **[1]**.

3.5.1. Talent puncturing the vein under ultrasound guidance with the hollow needle and confirming backflow through the hollow needle.

3.6. Immediately insert a guidewire through the hollow needle and advance it **[1]**. Then, remove the tourniquet and withdraw the hollow needle over the wire **[2]**.

3.6.1. Talent feeding the guidewire through the needle and advancing it further.

3.6.2. Talent removing the tourniquet and then withdrawing the needle while leaving the guidewire in place.

3.7. Next, flush the sheath and side port thoroughly to ensure no air remains in the system **[1]**. Introduce the 6 French sheath over the guidewire and then remove the guidewire and dilator, creating a 6 French lumen **[2]**.

3.7.1. Talent flushing both the sheath with saline using a syringe.

Talent advancing the sheath over the wire, then removing the wire and dilator to establish the lumen.

3.8. Use a 5 French flow-directed pacing catheter with the balloon **[1]** and introduce it deflated through the sheath and advance the pacing lead further **[2]**. **NOTE**: VO added for the extra shot

Added shot: Talent showing the balloon tip of the catheter by inflating and deflating it outside of the patient.

3.8.1. Talent inserting the pacing catheter into the sheath with the balloon tip deflated

and beginning to advance the lead.

4. Imaging Guidance Set-Up and Lead Advancement

4.1. Use fluoroscopy in an anterior-posterior 0-degree view to guide the pacing lead toward the right ventricle **[1]**. Continue advancing the pacing lead so it naturally follows the vascular path without resistance **[2]**.

4.1.1. SCREEN: JoVE68470_SCREEN-4.1.1.-AND-4.1.2._Screencapture-1.mp4 00:00-0:13.

4.1.2. SCREEN: JoVE68470_SCREEN-4.1.1.-AND-4.1.2._Screencapture-1.mp4 . 00:14-00:27 *Video editor: Please highlight the thin wire with 2 beads at the end advancing to the chest*

4.2. Once the lead tip reaches the subclavian vein, inflate the balloon to help steer it into the right ventricle **[1-TXT]**. ~~If the pacing lead veers into the contralateral subclavian vein or jugular vein, withdraw it slightly **[2]** and rotate the angulated tip before re-advancing **[3]**~~.

4.2.1. Shot of the screen showing the fluoroscopic view. **TXT: Rotate the angulated tip if required**

~~4.2.1.1. Optional: Talent withdrawing the lead.~~ **NOTE**: Not filmed, VO moved as on-screen text

4.2.1.2. ~~Optional: Talent adjusting and rotating the tip before readvancing~~.

4.3. To pass through the tricuspid valve, rotate the pacing lead and guide the balloon tip through the valve while inflated **[1]**.

4.3.1. SCREEN: JoVE68470_SCREEN-4.3.1._Screencapture-2.mp4. *Video editor: Please highlight the thin wire with 2 beads at the end advancing to the chest*

4.4. After the lead contacts the right ventricular apex, deflate the balloon **[1]**.

4.4.1. SCREEN: JoVE68470_SCREEN-4.4.1._Screencapture-3.mp4. *Video editor: Please highlight the tip of the wire*

~~4.4.2. Talent deflating the balloon tip of the catheter.~~ **NOTE**: Not filmed

5. Connecting, Testing and Fixing the Pacing Lead

5.1. When the pacing lead is properly positioned in the right ventricle, connect the electrode plugs to their corresponding ports on the adapter **[1]**.

5.1.1. Talent connecting the pacing lead's electrode plugs to the appropriate adapter ports.

5.2. Perform a capture threshold test by pacing at 20 beats per minute above the intrinsic heart rate at maximum pacemaker output **[1]**. Gradually reduce the output amperage until malcapture is observed, indicated by irregular heartbeat or a drop in heart rate below the pacemaker setting **[2]**. Ensure that the pacemaker output setting exceeds at least twice the measured threshold value **[3-TXT]**.

5.2.1. Talent showing external pacemaker and adjusting pacing rate to 20 beats per minute above intrinsic heart rate and output at maximum.

5.2.2. Shot of the monitor showing the heart activity.

5.2.3. Talent shows the pacemaker setting adjusted to exceed twice the identified threshold. **TXT: In this case: 2 mA threshold and 7 mA settings**

5.3. If the threshold exceeds 3 milliamperes, reposition the pacing lead to achieve a lower threshold **[1]**.

5.3.1. SCREEN: JoVE68470_SCREEN-5.3.1.-(1)_Screencapture-4.mp4. *Video editor: Please highlight the thin wire with 2 beads being retracted slightly and repositioned*

5.4. Finally, remove the sterile cover of the temporary pacing lead **[1]** and fixate it using a large transparent film dressing that covers the access site and approximately 10 centimeters of the external portion of the pacing lead **[2]**. **NOTE**: VO added shot the extra shot

Added shot: Talent removes the sterile cover prior to fixating the lead.

5.4.1. Talent positioning the external part of the pacing lead and applying a transparent film dressing over the access site and external pacing lead. **TXT: Lead fixation: Rolled up fashion**

~~5.5. Ensure proper fixation of the pacing lead to support extended pacing or as a backup, allowing the patient to move while keeping the lead in place **[1]**.~~

~~5.5.1. Talent checking lead stability by gently manipulating the arm and verifying the~~

lead remains secured.

5.6. If the pacing lead needs to be removed, confirm the balloon is deflated and gently retrieve the lead using slight traction **[1]**.

5.6.1. Talent checking if the balloon is deflated and pulling the pacing lead out slowly.

5.7. Keep the 6 French sheath in place until the activated clotting time returns to normal levels **[1]**. Once normalized, manually remove the sheath **[2]**.

5.7.1. Talent pointing to the the ACT measurements.

5.7.2. Talent manually withdrawing the sheath after ACT is confirmed normal.

5.8. Finally, apply manual pressure on the access site for 2 minutes **[1]**. Afterward, place a sterile bordered gauze or island dressing **[2]** and use a compression bandage if necessary **[3]**.

5.8.1. Talent compressing the access site with gloved fingers while monitoring time.

5.8.2. Talent placing sterile dressing.

5.8.3. Optional: Talent applying a light compression bandage.

Results

6. Results

6.1. In the trial, 238 patients were randomized between the upper-extremity and the lower-extremity cohort **[1].** Clinically relevant bleeding events were significantly lower in the upper-extremity group **[2]** compared to the lower-extremity group **[3]**.

6.1.1. LAB MEDIA: Figure 5

6.1.2. LAB MEDIA: Figure 5. *Video editor: Highlight the two "upper extremity" bars*.

6.1.3. LAB MEDIA: Figure 5. *Video editor: Highlight the two bars for "lower extremity*".

6.2. When the upper-extremity approach was used, time to mobilization was significantly shorter in patients requiring extended pacing or temporary pacing lead backup at around 530 minutes **[1]** versus 1415 minutes for the lower-extremity group **[2]**.

6.2.1. LAB MEDIA: Figure 6. *Video editor: Highlight the triangle in the BLUE bar in the "Pacing lead maintained" section corresponding to "upper extremity*"

6.2.2. LAB MEDIA: Figure 6. *Video editor: Highlight the triangle in the RED bar in the "Pacing lead maintained" section corresponding to "lower extremity"*