



# V-CLAMP SURGERY

Information about mitral valve repair in dogs



## LMU VETERINARY CARDIOLOGY SERVICE

Transcatheter-Edge-to-Edge Repair (TEER) to  
repair the mitral valve in dogs

[www.tierkardiologie.lmu.de](http://www.tierkardiologie.lmu.de)

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## Mitral valve degeneration in dogs

### Myxomatous mitral valve degeneration (MMVD)

**MMVD** is the most common heart disease in dogs, particularly small and medium-sized breeds.

**What it is:** MMVD is a degenerative condition where the mitral valve in the heart becomes thickened, floppy, and leaky. The mitral valve is located between the left atrium and left ventricle of the heart.

**How it happens:** The valve leaflets (the flaps of the valve) become thickened and lose their elasticity. This prevents them from closing properly, allowing blood to leak back into the left atrium.

**Consequences:** This backflow of blood puts extra strain on the heart, causing it to work harder. Over time, this can lead to:

**Heart enlargement:** The heart chambers may enlarge to try to compensate for the increased workload.

**Fluid buildup:** Fluid can accumulate in the lungs (pulmonary edema), causing coughing, difficulty breathing, and exercise intolerance.

**Heart failure:** In severe cases, the blood is backed up into the lungs, leading to congestive heart failure (CHF). In this case water is accumulating in the lungs.

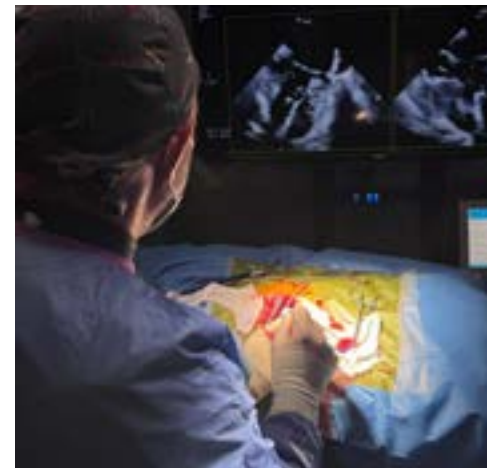


### Therapy Options

If the heart has enlarged, medication should be initiated. The drug pimobendan can prolong the asymptomatic period by approximately 15 months compared to no treatment. If fluid has accumulated in the lungs, diuretics and possible additional drugs will be used.



## ALTERNATIVE TREATMENT OPTION: TRANSCATHETER-EDGE-TO-EDGE REPAIR (TEER)



### What is the TEER procedure?

The Transcatheter-Edge-to-Edge-Repair (TEER-procedure) is a minimally invasive surgery to repair a leaking heart valve. It's done under anesthesia, while it's still beating. Therefore there is no need for a cardiovascular bypass machine and stopping the heart as it is with open-heart surgery.

The V-clamp device used in this procedure is similar to a device used in human heart surgery



### TEER surgery

The procedure is performed under general anesthesia.

A small incision is made in the chest, and the V-clamp device is guided into the beating heart using advanced imaging techniques (3D transesophageal echocardiography). This procedure helps to reduce the leak in the valve and improve heart function, without the risks associated with a full surgical procedure.

### Advantages of the TEER surgery

#### Minimally Invasive Surgery

- The transapical approach means that cardiopulmonary bypass is not required.
- **Shorter operative times** (40- 60 minutes) means less trauma and complications.
- **Rapid post-operative recovery** with most patients being discharged after few days.
- **Precise Leaflet Capture:**
  - Different size devices for different patient size and mitral regurgitation patterns
  - Multiple V-Clamp's can be used to reduce regurgitation if needed.







## FREQUENTLY ASKED QUESTIONS



### Does the procedure carry significant risk?

Unfortunately, all heart surgeries can involve complications, including fatalities. However, a recently published study reported successful outcomes in 48 out of 50 patients, with no fatalities (Potter et al., 2024). Future studies with larger patient numbers might report fatalities. Nonetheless, because the V-Clamp procedure avoids open-heart surgery and cardiopulmonary bypass, it is less risky compared to other methods of mitral valve repair.

### Will I still need to give my dog medications?

Typically, the number and/or dosage of medications required decreases. However, over time, dogs may show signs of heart failure again, necessitating the resumption of medications or dosage adjustments.



## The LMU-TEER-Team

Our multidisciplinary TEER Team at the LMU Small Animal Clinic, under the leadership of **Prof. Dr. Gerhard Wess**, Head of Veterinary Cardiology, includes 2 surgeons, 2 cardiologists, a TEE ultrasound specialist, and specialized support from anesthesia and emergency/critical care.

This collaborative approach ensures comprehensive care for our patients.

### Does recovery take long?

Patients are usually able to return home within a few days after the procedure, showing minimal signs of discomfort. Some patients may require mild pain relief during the first few days at home.

### How is the procedure performed?

The V-Clamp procedure is performed through a small incision (5–6 cm) low on the chest, between the ribs. The device is delivered via a catheter into the beating heart, avoiding the need for open-heart surgery with cardiopulmonary bypass. The procedure is guided by 3D transthoracic ultrasound and fluoroscopy.



## Follow-ups and costs

### Follow-up Care

To ensure your dog's continued health and well-being, we recommend regular check-ups for at least the first year following surgery. These visits can be scheduled with us or your regular veterinarian. Depending on your dog's individual needs, long-term cardiac care may be advised.

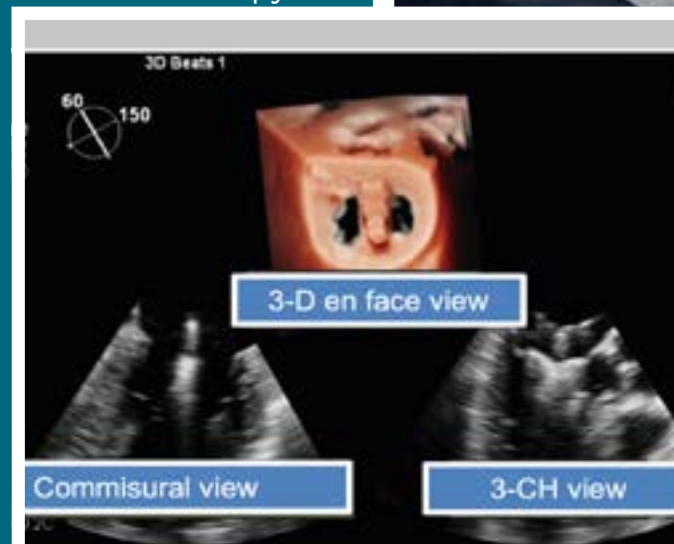
### Costs

The estimated cost of the procedure is €12,000 including stationary stay. If a second V-clamp is necessary during the initial surgery, there will be no additional charges.

**Contact:** please do not hesitate to contact us for further information and scheduling an appointment using the email below:

### DOES THE TEER PROCEDURE HELP MY DOG?

A new study on the first long term outcome and clinical evaluation of the TEER procedure showed that the procedure is a comparatively low-risk surgery leading to significant reduction in the severity of mitral regurgitation. The 2-year survival rate of 80% in late B2 and C patients is therefore much better than with medications alone.



**KLEINTIER.KARDIOLOGIE@LMU.DE**





## PATIENT SELECTION

### Is My Dog a Candidate for Surgery?

**A comprehensive evaluation is crucial.**

Determining whether your dog is a suitable candidate for V-clamp surgery requires a thorough examination.

Why a thorough examination is essential:

**Individual assessment:** Every dog is different. Only a detailed examination can reveal your dog's specific condition.

**Risk assessment:** Surgery carries risks. Careful consideration is necessary to ensure the benefits outweigh the potential risks for your dog.

**Alternative treatment options:** Depending on your dog's condition, other treatment approaches may be considered.



**Suitability for the surgery** is determined based on a thorough evaluation of your dog's heart condition. The following criteria apply:

**Weight:** Between 3 and 15 kg.

**Condition:** Severe mitral valve insufficiency (**late stage B2** or **early stage C**).

**Anatomy:** Suitable valve structure for repair (e.g., A2 segment prolapse).

**General health:** No significant health problems outside the heart.

Initial eligibility is determined by the **LMU Veterinary Cardiology TEER Team** after echocardiographic evaluation of the patient. If your local cardiologist made an echocardiographic examination including some special views, we can review the **DICOM images, i.e. video loops** before you travel to Munich. Final determination for eligibility is made under anesthesia by transesophageal echocardiography just prior to the procedure.

A **downloadable link to the Dicom images** should be sent by email to: [kleintier.kardiologie@lmu.de](mailto:kleintier.kardiologie@lmu.de).

**WWW.TIERKARDIOLOGIE.LMU.DE**

## CONTACT US FOR FURTHER INFORMATION



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**WE ARE HERE  
TO HELP**



# INFOS FOR REFERRING CARDIOLOGISTS

## ECHO-VIEWS to obtain for TEER pre-evaluation

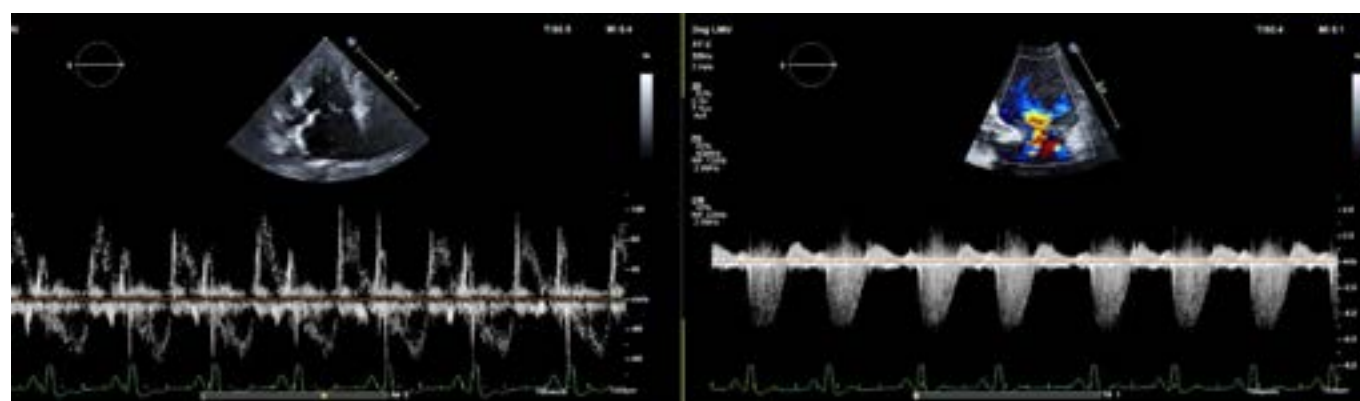
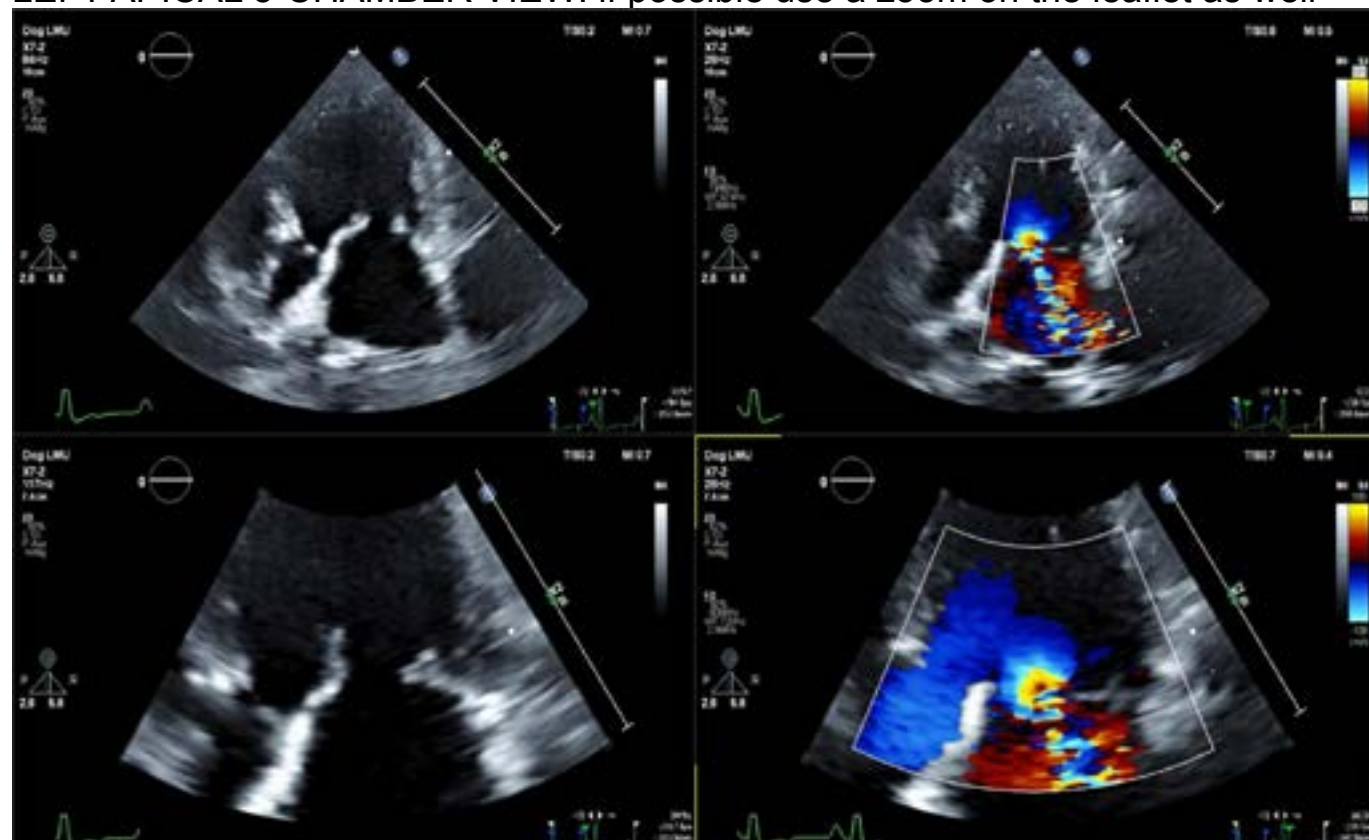
Please acquire all views as **loops (videos)** (exception PW/CW/M-mode) with 3 cardiac cycles (or 3 seconds).

**Export them in DICOM format** and send the study using wetransfer or similar to: [kleintier.kardiologie@lmu.de](mailto:kleintier.kardiologie@lmu.de)

Also please send us your measurements, staging and drugs that the dog is currently getting.

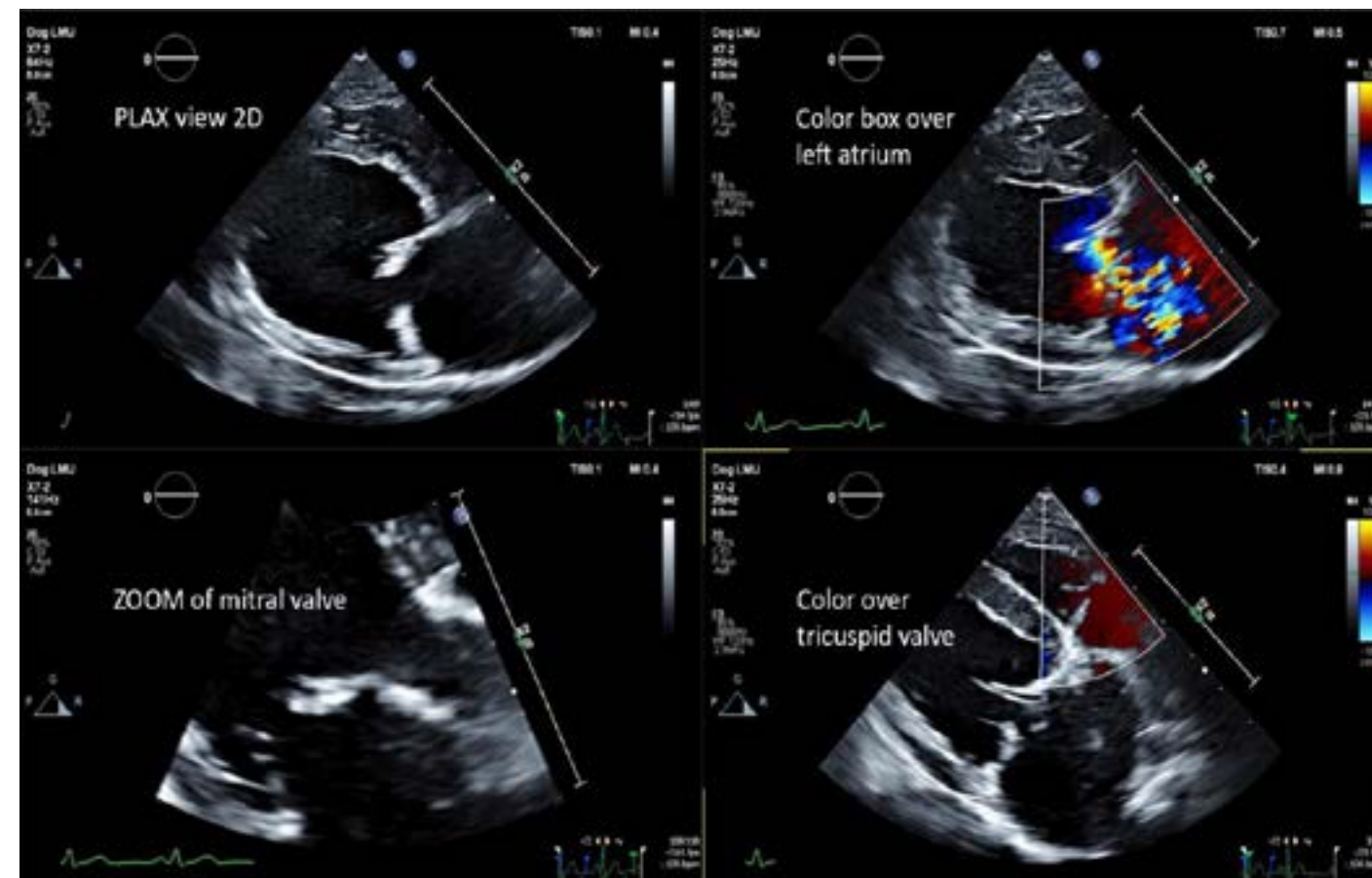
**MOST IMPORTANT VIEW IS A 5-CHAMBER VIEW (OR A 3-CHAMBER VIEW) WITH THE AORTA OPEN. PLEASE ENSURE THAT BOTH MITRAL LEAFLETS ARE CLEARLY VISIBLE.**

**LEFT APICAL 5-CHAMBER VIEW:** if possible use a zoom on the leaflet as well



### Additional views

Parasternal Longaxis from right side (2D and with color)



Inflow-Outflow view with aorta open:



LA/O short axis or LA-long axis:

