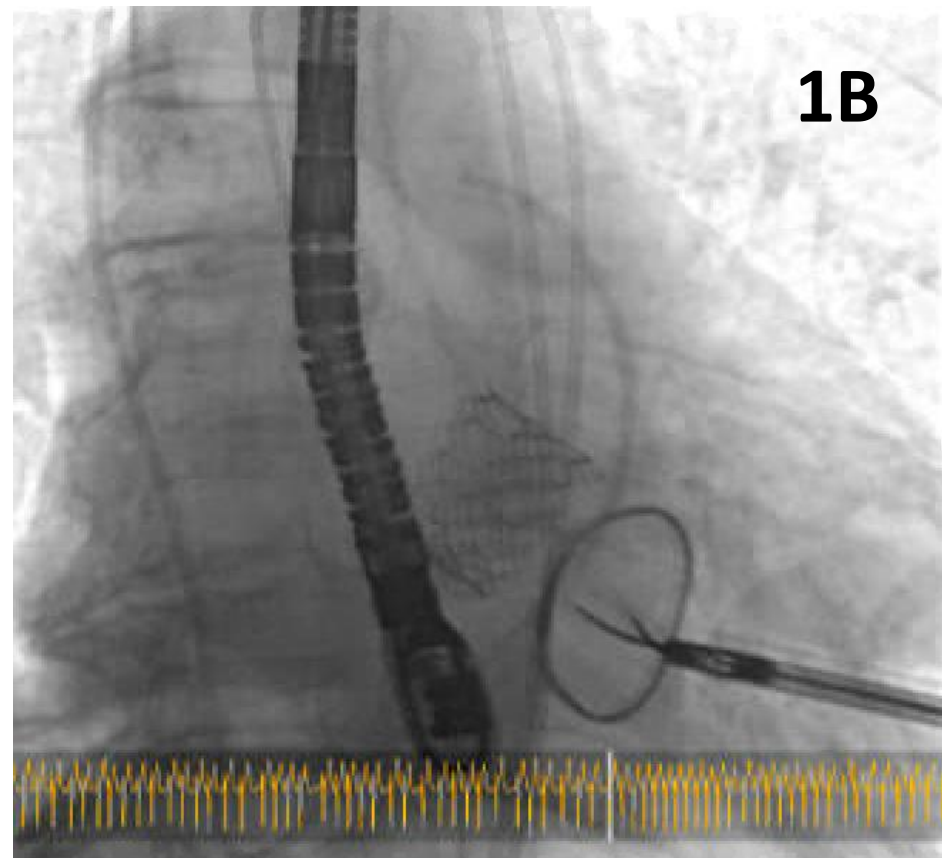
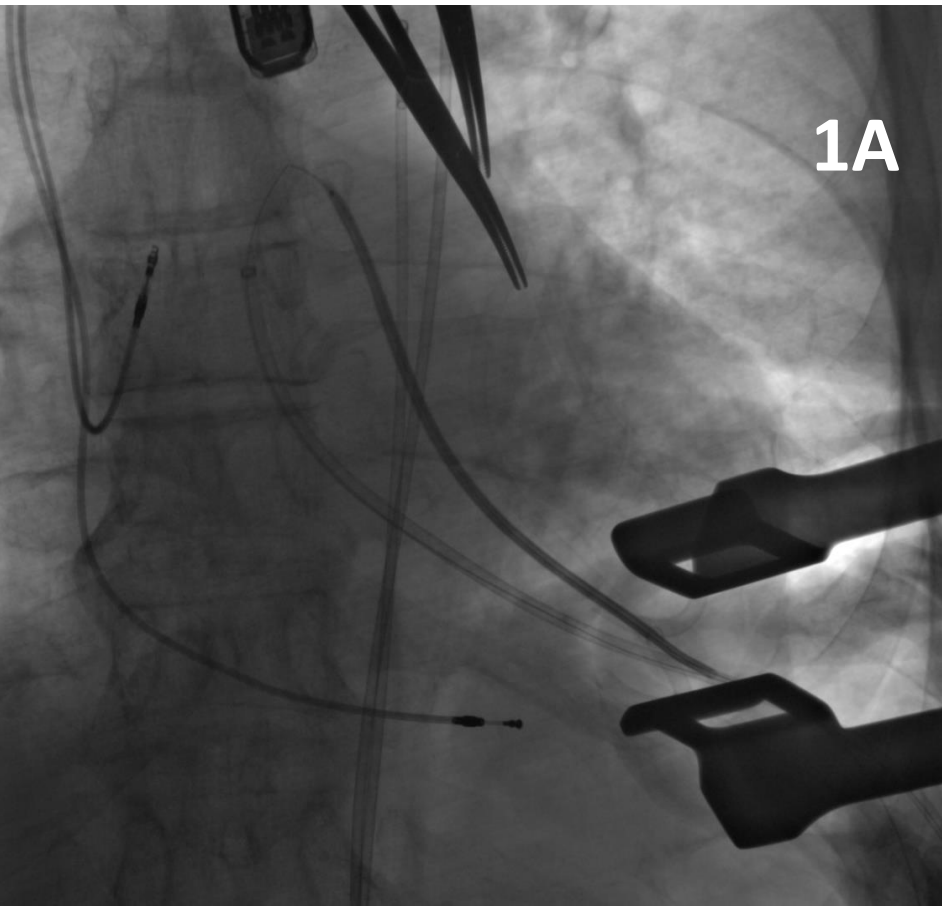


Objective

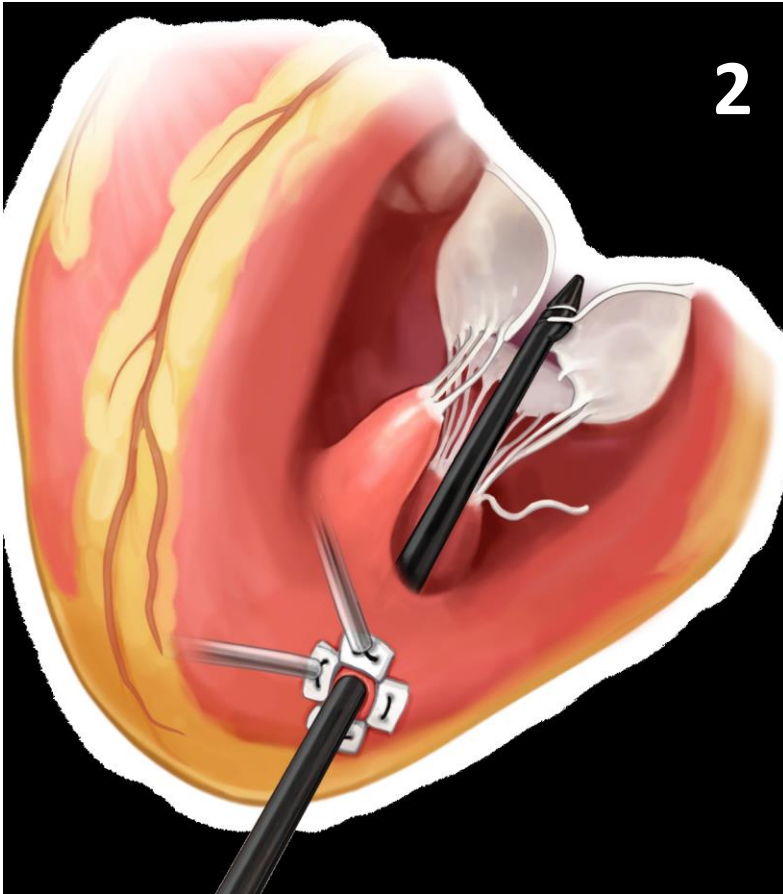
We aimed to describe the currently available devices for beating heart treatments in mitral valve regurgitation (MR) using the transapical approach. At our center, we have gathered experience over the past years using various devices such as the Abbott Tendyne© device, the NeoChord© artificial chordae delivery system, transapical Edwards Sapien 3© in mitral position and the Edwards HARPOON© system. A descriptive analysis was performed of each subgroup of devices used for transapical mitral valve repair and replacement.

Device subgroup analysis

Transcatheter, transapical mitral valve replacement (TMVR) using the Abbott Tendyne© device



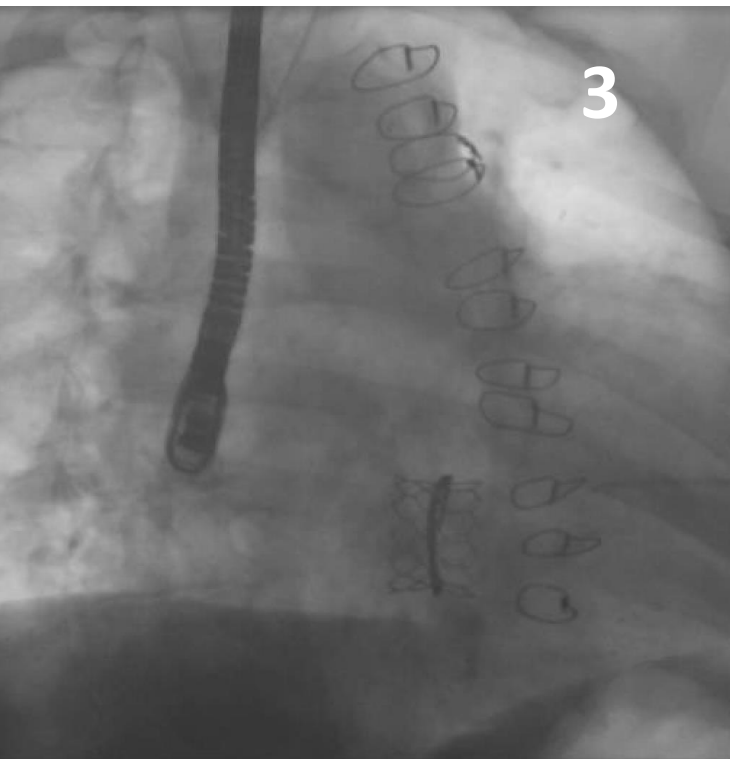
- Largest of the beating heart transapical MR treatment device groups (n = 41)
- Novel modality to treat severe MR in patients not eligible for conventional mitral valve surgery
- Very promising results, with a 30-day mortality at our center of 0%
- Potential complication of TMVR is the dynamic obstruction of the left ventricular outflow tract (LVOT) by the native anterior mitral valve leaflet (AML), which may result in systolic anterior motion
 - We were able to successfully address this issue by implementing a modified LAMPOON procedure (Laceration of the Anterior Mitral leaflet to Prevent Outflow Obstruction), a transcatheter electrosurgical technique designed to split the AML prior to TMVR via an apical access.
 - We also performed direct, transapical scissor-mediated modification of the AML in a patient undergoing transcatheter double valve replacement.
 - Finally, we performed an electrosurgical laceration and stabilization of mitral clips (ELASTA-CLIP) as a bail-out technique, recreating a single orifice mitral valve after transcatheter edge-to-edge repair (TEER) with subsequent transcatheter mitral valve replacement (TMVR).



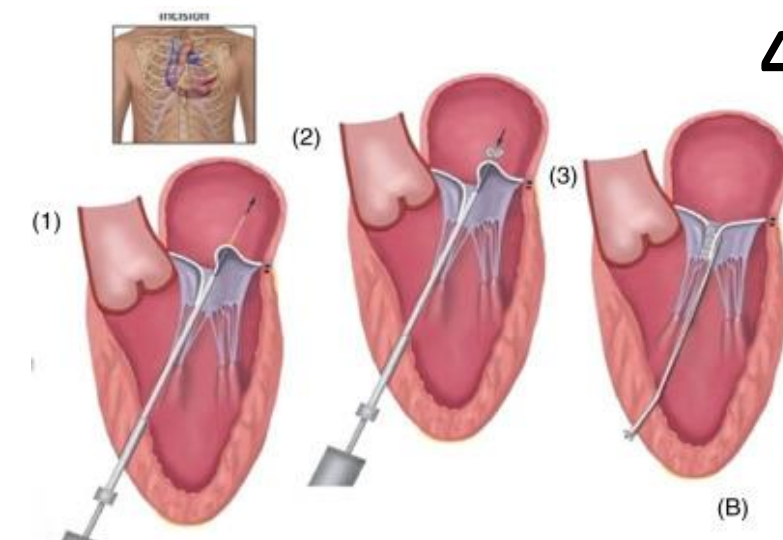
NeoChord© artificial chordae delivery system

- Another beating heart procedure using a transapical access we perform at our center (n = 20)
- The 30-day mortality was 5% (one patient)
- Postoperative reduction of severe MR in all but 1 patient (95%), by implanting a median of 3 artificial chordae
- In spite of this, 20% of the patients developed at least moderate recurrent MR within the first 2 years

Transapical TAVR using the Edwards Sapien 3© in mitral position



- Implantation of the Edwards Sapien 3© in mitral position using a transapical approach (n = 7)
- The transfemoral access with transseptal puncture inevitably limits the maneuvers in the left atrium and valve positioning, increasing the difficulty of a high-profile prosthesis to reach an angled mitral annular plane, which is not the case in a transapical access
- Technical challenges with LVOT obstruction forced us to convert to a sternotomy in two out of the seven patients
- TAVR in native mitral valve leaflet remains a high risk procedure



Edwards HARPOON© system

- Gained initial experience (n = 2) with the system designed to treat MR based on posterior leaflet prolapse
- System was taken off the market in October 2022

Conclusion

Minimally invasive transapical beating heart treatment options for severe MR have increased tremendously over the last couple of years. This allows high risk patients a range of alternatives to the classic mitral valve surgery.

Based on our institutional experience, we conclude that among all currently available devices, the Tendyne© TMVR system seems to be the safest and most reliable treatment option.

Images used

1A) KUK patient who received a modified transapical LAMPOON-procedure due to predicted LVOT obstruction for transapical mitral valve replacement using the Tendyne© device
1B) KUK patient who received a simultaneous TAVR and off-label valve-in-ring TMVR using a transapical approach as well as a laceration of the AML using endoscopic scissors
2) NeoChord [Internet]. Louis Park, MN, USA: NeoChord, Inc.; 2020. <https://neochoord.wpmudev.host/patient-education/>
3) KUK patient who received 08/2018 an Edwards Sapien 3 29 mm in mitral position following mitral valve annuloplasty (Physio II Ring 32 mm) and triple coronary bypass surgery 2009
4) Andrea Colli, Gino Gerosa, et al. Chapter 21 - Transcatheter mitral valve therapies for degenerative and functional mitral regurgitation. Emerging Technologies for Heart Diseases, Academic Press, 2020, DOI: 10.1016/B978-0-12-813706-2.00021-X.