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Transapical off-pump implantation of artificial mitral neochords in a patient after Bentall procedure - case report

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Abstract: The NeoChord DS 1000 system offers a minimally invasive alternative for treating degenerative mitral regurgitation (MR), particularly in high-risk patients with previous aortic surgery. A 74-year-old male with a history of Bentall procedure presented with severe MR and dyspnea (NYHA III). Transapical mitral valve repair was performed using the NeoChord DS 1000 system. Three artificial chordae were implanted, significantly reducing MR. The patient had an uneventful recovery and was discharged in good condition after 8 days. This case demonstrates the NeoChord system's potential in high-risk patients where traditional MVR poses high risks. Transapical access avoids sternotomy and extracorporeal circulation, offering a safer alternative. The NeoChord DS 1000 system shows promise for high-risk patients and those with complex surgical histories, though further research is needed to confirm its long-term efficacy and durability.

Keywords: NeoChord DS 1000 system, Bentall procedure, Mitral valve repair(MVR), cardiac surgery.
**Introduction:** Transapical artificial chords implantation using the NeoChord DS 1000 system is a safe innovative minimally invasive method that allows for a significant reduction of degenerative mitral regurgitation (MR) (1,5). It seems to be a potential alternative to classic methods of mitral valve repair (MVR) in the most burdened patients, including those after previous aortic surgery. We present an exceptional case of miniinvasive MVR using NeoChord DS 1000 system in a patient who underwent surgical treatment of the ascending aorta aneurysm and aortic valve disease in the past.

**Case presentation:** A 74-year-old man after Bentall de Bono procedure in 2003, was admitted to the hospital due to worsening of exercise tolerance and dyspnoea (NYHA III). Echocardiography showed severe eccentric mitral regurgitation due to anterior mitral leaflet prolapse caused by the rupture of native tendinous chords (Fig. 1, 2).

**FIGURE 1. A-** Eccentric jet of mitral regurgitation directed at the posterior mitral leaflet (color Doppler)
FIGURE 2. 1- Prolapse of anterior mitral leaflet (flail), large coaptation defect, 2- Acoustic shadow from a mechanical prosthesis in the aortic position

Due to previous aortic surgery (Bentall procedure), MVR was performed transapically using the NeoChord DS 1000 system under transoesophageal echocardiography guidance with 3D option (Fig. 3, 4).

FIGURE 3. C- Echo 3D: view of the mitral valve from the left atrium ("en face"). Visible prolapse of the anterior lobe with a rupture of the tendon chord (arrow)
The patient was generally anesthetized. A small incision was made on the left side of the chest and at the apex of the heart through which the catheter with the NeoChord DS 1000 system was inserted. During the operation three artificial chords were implanted, with a good coaptation result and a significant reduction of MR, from severe to small (Fig. 5, 6).

FIGURE 4. D- Echo of the artificial chord implanted to the anterior mitral leaflet (white point-arrow)

FIGURE 5. E- Coaptation of mitral leaflets after artificial chords implantation
The postoperative period was uncomplicated. A follow-up echocardiographic examination confirmed a good result of the procedure and the patient was discharged in good clinical condition after 8 days of stay in the ward.

**Discussion:** Classic methods of mitral valve repair in patients after Bentall's surgery are burdened with a high operational risk due to the limited visibility of the mitral annulus due to the rigid cuff of the aortal prosthesis. [3]. Other surgical techniques sometimes require prior removal of the aortic valve, suturing the mitral valve, and re-implantation of the aortic valve, which prolong the procedure and increase the risk of complications. [4]. Transapical access guided by transoesophageal echocardiography is a potential alternative to other methods that require sternotomy. Avoidance of extracorporeal circulation is another potential advantage, especially for patients with coronary artery disease, advanced aortic atherosclerosis, obstructive pulmonary dysfunction and renal failure [5]. Importantly, it can also be successfully used in selected patients after unsuccessful conventional surgical MVR [2]. Due to the use the NeoChord system, there is no interference with the aortic valve which is a chance to avoid severe complications in patients with high surgical risk. A transapical alternative method of MVR may be a proposition for such patients, however, it requires further studies.

**Conclusions:** While this case report demonstrates the potential of the NeoChord system,
further research is needed to validate these findings. Large-scale studies and long-term follow-ups are essential to establish the durability and overall efficacy of this innovative approach. Nonetheless, the NeoChord system presents a valuable option for high-risk patients and those with complex surgical histories, potentially improving their surgical outcomes and quality of life.

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**Data Availability Statement**
All relevant patient data is provided in the manuscript.

**Conflicts of Interest**
The authors declare no conflict of interest.

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