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Transapical off-pump Neochord implantation on bileaflet prolapse to treat severe mitral regurgitation

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Abstract

A 74-year old lady was admitted for the presence of a symptomatic severe mitral regurgitation (MR) due to bileaflet prolapse. The patient refused any surgical conventional procedure because of severe arthrosis and osteoporosis documented by previous fractures requiring knee and hip replacements, and was sent directly to us for transapical off-pump mitral valve repair with Neochord implantation (TOP-MINI procedure). The TOP-MINI procedure was performed under general anaesthesia and transoesophageal echocardiographic guidance. Four Neochordae were implanted on the posterior leaflet and two on the anterior leaflet in order to correct a residual anterior prolapse that was not seen at preoperative screening. After 11 months of follow-up, the patient presented with recurrence of symptomatic moderate MR due to rupture of one of two neochordae implanted on the anterior leaflet and new onset of atrial fibrillation. The patient underwent uneventful mitral valve replacement.

Keywords: Mitral regurgitation • Transapical mitral valve repair

Transapical off-pump mitral valve (MV) intervention Neochord implantation (TOP-MINI, Neochord Procedure) is a MV repair technique that has been proved to have a safety and efficacy profile in patients with degenerative mitral regurgitation (MR) due to a flail leaflet or prolapse of one leaflet (anterior or posterior) [1–5]. The procedure is performed only under direct 2D/3D transoesophageal echocardiographic (TOE) guidance for both implantation and final tensioning of the Neochords, as previously shown [4].

We present here the case report of a patient with severe MR due to bileaflet MV disease treated with the TOP-MINI procedure.

CASE DESCRIPTION

A 74-year old lady came to our attention for the presence of a symptomatic severe MR. TOE showed a posterior leaflet prolapse (eccentric holosystolic jet) with a preserved ventricular function (Left ventricular ejection fraction 70%, Left ventricular end diastolic volume indexed 59 ml/m², annular dimensions: antero-posterior 28 mm, latero-lateral 36 mm) (Fig. 1, Video 1).

The patient was admitted in NYHA functional class III. Her medical history was significant for drug-resistant systolic hypertension with a previous crisis that required hospital admissions, and diabetes. The Logistic EuroSCORE estimated risk and the STS score were 3.25 and 1.70%, respectively. The patient refused any surgical

conventional procedure because of a severe arthrosis and osteoporosis documented by previous fractures requiring knee and hip replacements. Owing to the presence of general physical and psychological frailty of the patient, we proposed to her a TOP-MINI procedure, evidencing the limitation on long-term follow-up.

The TOP-MINI procedure was performed under general anaesthesia and TOE guidance (2D mitral view at 120–130° with the X plane for ventricular navigation and then 3D 'surgical view' of the MV for neochord implantation) [4]. We performed a left posterolateral mini-thoracotomy and through a transapical access four Neochords were implanted on the posterior leaflet in a straightforward manner. During neochord tensioning and length adjustment, a residual prolapse of the anterior leaflet was observed, causing a residual moderate MR. Therefore, we decided to attempt the correction of the residual defect with the implantation of other two neochords on the anterior leaflet, using the same access. The final result of the procedure showed the presence of mild residual MR with a central jet (Fig. 2, Video 2).

The procedural time was 120 min (skin to skin); no complication occurred. Standardized perioperative blood salvage with cell saver was applied. The cell-saver blood returned was 560 ml with a post-procedural haematocrit similar to that of the preoperative period, not requiring any heterologous blood transfusion (preoperative haemoglobin was 14.5 mg/dl, post-procedural 14.1 mg/dl). The patient was discharged uneventfully 4 days after the surgical procedure.

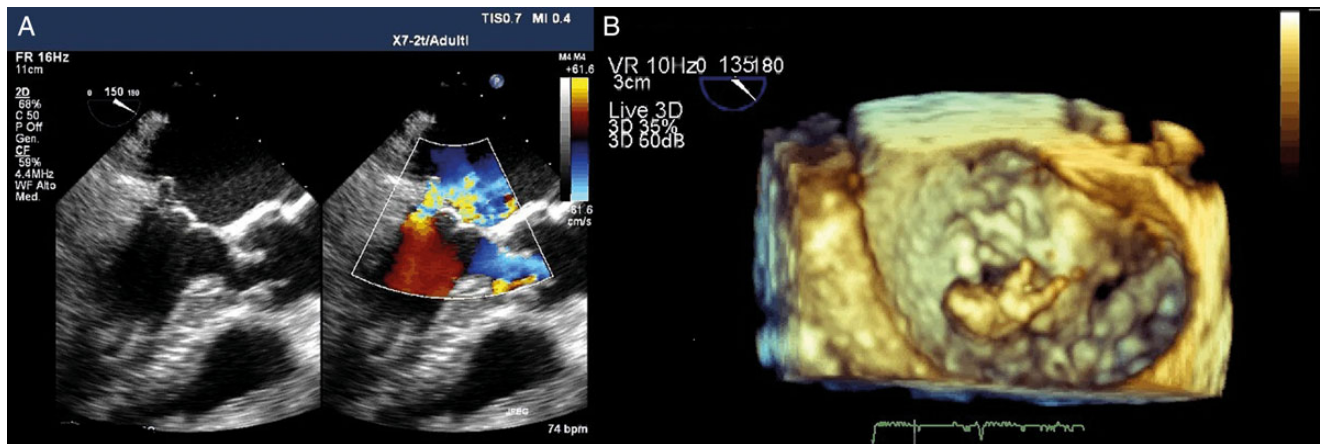
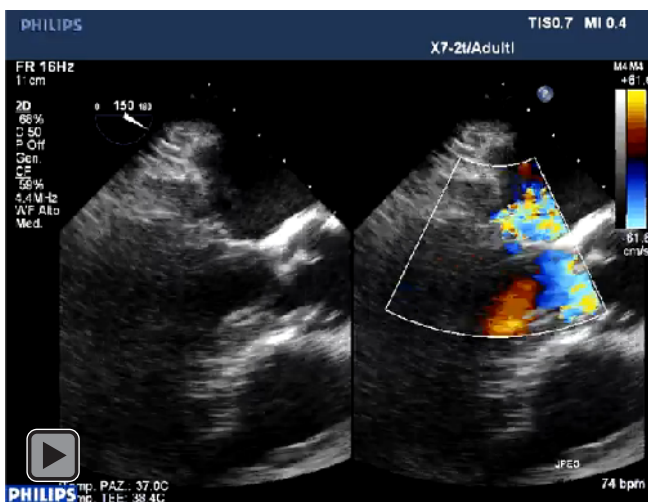


Figure 1: Preoperative TOE: severe mitral regurgitation with eccentric jet (A) and 3D view with the posterior leaflet prolapse on P1-P2 segments (B). TOE: transoesophageal echocardiography.



Video 1: Preoperative 2D-TOE: severe mitral regurgitation with posterior prolapse and an eccentric jet. TOE: transoesophageal echocardiography.

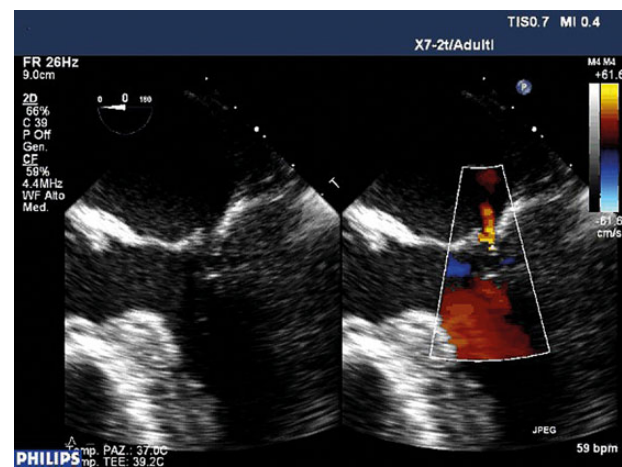
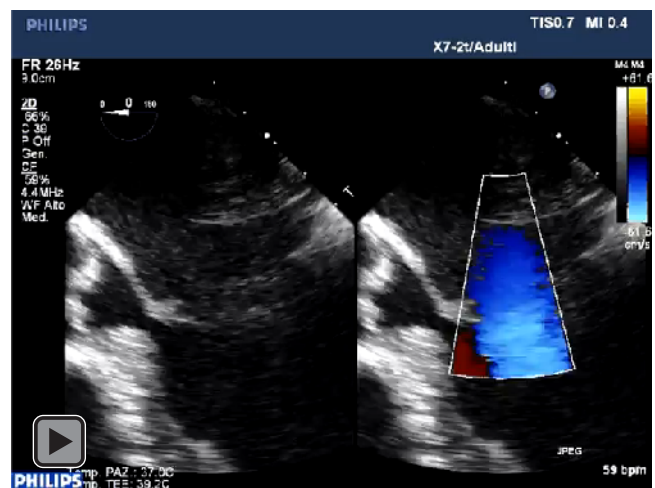


Figure 2: The final result on 2D-TOE: the bileaflet was corrected and valve competence was achieved with mild residual mitral regurgitation. TOE: transoesophageal echocardiography.

At the 9-month follow-up, she presented with mild residual MR. At 11 months, she presented with recurrence of moderate MR that together with an LV restrictive pattern and new onset of atrial fibrillation made her symptomatic and with difficult pharmacological management. For this reason, she underwent MV replacement with a 33-mm porcine bioprosthesis (SJM Epic, MN, USA). Intraoperative findings showed that all the chordae on the posterior leaflet were in place and completely endothelialized; of the two chordae on the anterior leaflet, only one was left in place; the second one was attached at the apex but its insertion on the leaflet was torn. The neochords were easily identified because, despite the fact that they were completely endothelialized, they were very straight and paired differently from native short and fan-shaped chordae.

This case demonstrates the technical feasibility of the implantation of neochordae on both mitral leaflets using the TOP-MINI procedure. This approach was associated with a significant reduction of MR that was maintained for almost 1 year, suggesting that this therapeutic option is technically feasible and could be considered also in selected patients with bileaflet disease after future evaluations. The late recurrence of moderate MR due to flail of the anterior leaflet taught us that we should implant at least four chordae on the anterior leaflet in order to distribute adequately the tension that each neochord should manage. It is important to



Video 2: Postoperative 2D-TOE: no other prolapsing leaflets were detectable and only a mild residual mitral regurgitation was present. TOE: transoesophageal echocardiography.

underline that the anterior leaflet normally covers two thirds of the entire MV orifice with consequent high forces to support compared with the posterior leaflet.

The transapical access is more postero-lateral than for TAVI. The need of this special access is based on the anatomy of the MV apparatus that is more 'posterior' with respect to the aortic valve. The neochords need to be aligned as much as possible to the native chord in order to diminish any type of excessive tension that could lead to leaflet tear. The need of this access is also required in order to simplify the ventricular navigation of the device and the crossing of the MV, diminishing the risk of interference with the sub-valvular apparatus.

It is also important to underline that the lack of an annuloplasty ring has to be addressed with future long-term follow-ups, in particular in patients with initial LV dilatation; for this reason, we have to highlight that the greatest benefits of the TOP-MINI procedure were seen when performed at an early stage of the degenerative disease, i.e. when the pathology was limited to the leaflets.

In conclusion, this case report demonstrates that transapical off-pump neochord implantation to treat bileaflet prolapse is technically feasible but it needs future refinements in order to improve long-term durability and reproducibility. At this moment, the present technique should be applied only in selected cases.

Conflict of interest: Andrea Colli, Demetrio Pittarello and Gino Gerosa received travel grants from the Neochord, Inc.

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