

## SURGICAL VIDEO

# Dissection Flap Fenestration with a Transjugular Intrahepatic Portosystemic Shunt Needle: An Adjuvant Technique in Endovascular Treatment of Post-Dissection Thoraco-Abdominal Aortic Aneurysms

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**Introduction:** In chronic aortic dissection complicated by aneurysmal degeneration, the absence of spontaneous tears between the true and false lumen at visceral artery level may limit treatment by fenestrated/branched endovascular aneurysm repair (F/BEVAR). The creation of new fenestrations may be required to allow access to the visceral vessels.

**Technique:** In this video, the endovascular treatment of a 70 year old white man with chronic type B aortic dissection complicated by Crawford type II thoraco-abdominal aortic aneurysmal degeneration is presented. The right renal artery had a false lumen origin without nearby visible re-entry tears. He underwent dissection flap fenestration at visceral vessel level using a transjugular intrahepatic portosystemic shunt (TIPS) needle and subsequent dilation with a high pressure balloon. A Zenith TX2 dissection endovascular graft was deployed proximally and extended distally with a Zenith dissection endovascular stent until the fenestration level was reached. In a second stage, a F/BEVAR was performed, with fenestration to the left renal artery and branches to right renal artery, superior mesenteric artery, and coeliac trunk. One year follow up computed tomography angiography showed visceral branch patency and a reduction of the aneurysm sac.

**Discussion:** The chronic dissection flap may be thick and fibrotic, creating a technical challenge for endovascular fenestration. The off label use of a TIPS needle in this procedure created a new fenestration at the desired level and allowed definitive post-dissection treatment of the thoraco-abdominal aneurysm.

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## INTRODUCTION

The late consequence of medical therapy for uncomplicated type B dissection is aneurysmal degeneration, which occurs in up to 50% of patients, despite optimal conservative therapy.<sup>1,2</sup>

If the type B dissection involves the visceral aorta, false lumen enlargement may cause a progression to a thoraco-abdominal aortic aneurysm (TAAA). This aneurysm commonly shows spontaneous tears between the true and false lumen at the level of visceral arteries, which correspond to the arteries' ostia when arising from the false lumen.<sup>2</sup> In some cases, these can be catheterised, allowing the passage of bridging stents during the endovascular

repair. However, in its absence, difficult identification or adverse location, treatment with fenestrated/branched endovascular aneurysm repair (F/BEVAR) is limited.<sup>3,4</sup> This problem may be overcome by creating a new fenestration at a favourable location, dilating it to make a wide communication between the true and false lumen and allowing access to the visceral vessel.<sup>4,5</sup>

## TECHNIQUE

In this video, the case of a 70 year old white man with a prior history of heavy smoking and well controlled hypertension is presented. He had an acute uncomplicated type B aortic dissection in 2014, which was managed conservatively with a beta blocker and blood pressure control.

During follow up, progressive aneurysmal degeneration was noted. Four years later, the Crawford type II TAAA reached a maximum diameter of 62 mm, and a staged endovascular repair was planned. The left renal artery, superior mesenteric artery (SMA), and coeliac trunk had a true lumen origin; the right renal artery had a false lumen

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origin with no nearby re-entry tears. The true lumen was significantly compressed at the level of the descending thoracic and visceral aorta.

Written consent was obtained from the patient for the planned procedure and anonymous use of data and images for scientific purposes.

In the first stage, via percutaneous bifemoral access, a dissection flap fenestration at SMA level was performed using a transjugular intrahepatic portosystemic shunt (TIPS) needle. The TIPS needle set (Cook Medical, Bloomington, IN, USA) includes a 9 F 38.5 cm introducer sheath and a metallic 16 G 50.5 cm needle that travels inside a rigid catheter. The natural curves of the sheath and the catheter were manually increased before its introduction over the less tortuous left iliac artery. After suitable positioning of the 9 F sheath in the infrarenal aortic true lumen, double aortic lumen angiography and multiple projections were performed. It safely guided the catheter and needle through the sheath, safely oriented the needle—catheter assembly curve, and allowed proper needle puncture perpendicularly from the true to the false lumen. The false lumen needle position was confirmed by contrast injection, and a stiff wire was introduced across the neofenestration. Progressive dilation of the neofenestration with successive increasing diameter high pressure balloons resulted in a large fenestration tear.

A Zenith TX2 (Cook Medical) dissection endovascular graft (34 × 204 mm) was deployed proximally in the same procedure, covering the primary entry tear and extending up to the middescending thoracic aorta. It was extended with a Zenith dissection endovascular stent (36 × 120 mm; Cook Medical) to SMA level, using the petticoat technique. Gentle post-dilation with a Coda Balloon (Cook Medical) allowed true lumen enlargement up to the newly created fenestration tear level. The procedure required 70 mL contrast media and lasted 85 minutes.

In the second stage, six weeks later, the patient underwent F/BEVAR using a custom made Zenith fenestrated abdominal aortic aneurysm (AAA) endovascular graft (36 × 211 mm), with fenestration to the left renal artery (Advanta V12 [Getinge, Gothenburg, Sweden], 7 × 22 mm) and branches to the right renal artery (Advanta V12, 7 × 59 mm), SMA (Advanta V12, 8 × 59 mm), and coeliac trunk (Advanta V12, 9 × 59 mm). It was extended with a bifurcated Zenith Alpha abdominal endovascular graft to the level of the iliac arteries (main body 24 × 130 mm; right iliac limb 16 × 77 mm). Open axillary artery exposure and percutaneous bifemoral access were used. The patient received peri-operative cerebrospinal fluid drainage. This procedure required 150 mL contrast and lasted 240 minutes. The post-operative period was uneventful, and the patient was discharged home after five days.

One year computed tomography (CT) angiography confirmed patency of all visceral branches and a reduction of the aneurysm sac to a maximum diameter of 59 mm,

without contrast enhancement of the false lumen. A small type 2 endoleak arising from the median sacral artery was noted in the abdominal aorta. At the two year follow up, the patient remained asymptomatic.

## DISCUSSION

In the presented case, a complex post-dissection TAAA was successfully treated in a staged procedure with a combination of endovascular solutions that included the off label use of a TIPS needle to create a fenestration for the right renal artery.

Percutaneous fenestration is generally described for endovascular treatment of malperfusion syndrome in acute type B dissection.<sup>2,5</sup> A tear is created in the dissection flap near the critically affected branch artery to improve perfusion. The back end of a 0.014" wire is often used to perforate the dissection flap close to the compromised aortic branch, but several kinds of devices may be used, such as curved needles (trans-septal needle and TIPS needle) or re-entry devices.<sup>3,5,6</sup>

In post-dissection TAAAs with visceral vessels arising from the false lumen without nearby natural fenestration, a fenestration procedure may be required to allow the definitive complex endovascular aortic repair. The chronic dissection flap is usually stiff and fibrotic, and cannot be penetrated with a small calibre guidewire.<sup>2,5,6</sup> It may require coarse devices to transverse it, such as the TIPS needle, with a large calibre and limited torquability.<sup>3</sup> To minimise the risk of aortic injury, several details are essential. Firstly, the TIPS needle should only be used in patients with a large false lumen diameter at the location of the target vessel.<sup>3</sup> Secondly, this stiff metallic device should be advanced through the less tortuous iliac artery.<sup>3</sup> Thirdly, the needle should be pushed perpendicular to the flap, using a short, controlled jab.<sup>3,5,7</sup> It should be felt as tactile feedback from touching the dissection flap.<sup>3</sup> If both lumens are not well visualised using a single angiographic catheter in the true lumen, the use of two angiographic catheters is recommended, one each lumen; it is also proposed that multiple projections are used to position the needle tip at the centre of the flap coming from the true lumen via the femoral artery. After confirmation of the position across the rigid flap from true to false lumen by contrast injection, angioplasty balloons of sequentially larger diameters are inflated. This creates a large fenestration tear from a relatively small needle puncture hole, increases the true lumen diameter (allowing an endoprosthesis deployment), and allows visceral vessel catheterisation (for F/BEVAR as the definitive treatment). Fusion mask, intravascular ultrasound, or intra-operative cone beam CT could be useful imaging tools for this procedure but were not used owing to limited availability.<sup>3,4</sup>

The optimal strategy for endovascular fenestration remains controversial, and there are no strict guidelines for this procedure.<sup>6</sup> In the presented case, using the TIPS

needle to create a neofenestration was safe and effective. It allowed definitive endovascular treatment of a post-dissection TAAA in a staged fashion.

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#### CONFLICTS OF INTEREST

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#### APPENDIX A. SUPPLEMENTARY DATA

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.ejvsf.2021.07.001>.

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