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Case report

Looping wire technique to facilitate true lumen wiring during TEVAR in type B aortic dissection with aneurysmal degeneration: A case report

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ABSTRACT

Introduction and importance: Wiring true lumen during Thoracic Endovascular Aortic Repair (TEVAR) is sometimes difficult in complicated Type B Aortic Dissection (TBAD).
Case presentation: We treated a TBAD patient with large false lumen, compressed true lumen and multiple entries. After repeated wire misdirection to false lumen, we tried a new technique in which the wire in the false lumen was looped after entrance to true lumen and pushed distally. The looped wire was then used as guide to advance a second wire to the ascending aorta. TEVAR could then be completed with good result.
Discussion: Wiring the true lumen might be one of the most challenging steps during TEVAR in complicated TBAD. Several methods have been used to overcome the problems, but the cost and availability might be a problem in some countries. The looping wire technique may serve as an alternative method of guiding the process of wiring the true lumen during complicated TEVAR.
Conclusion: Looping wire technique can be used as an alternative method to facilitate true lumen wiring during TEVAR.

1. Introduction

Thoracic Endovascular Aortic Repair (TEVAR) has become the standard therapy for aortic aneurysm as well as complicated aortic dissection involving the descending aorta with anatomically suitable lesions [1]. Placing a wire from access vessel (femoral artery) up to the ascending aorta is an essential procedure before placement and deployment of the stent graft. While generally it is not too difficult to perform in case of aortic aneurysm, it might be really difficult in complicated cases of aortic dissection. Enlarged false lumen, compressed true lumen and the presence of multiple entry tears might cause preferential direction of the wire to the false lumen and may increase the risk of rupture, retrograde dissection and deployment of stent graft in the false lumen [2–5].

There have been several methods to make sure the true lumen course of the wire, including inserting wire from right brachial artery down to the femoral artery or using imaging modalities such as transoesophageal echocardiography (TOE) or Intravascular Ultrasound (IVUS), all of which has its advantages and drawbacks [4]. In this report, we would like to introduce a simple looping wire technique to facilitate true lumen wiring during TEVAR in type B aortic dissection (TBAD) with aneurysmal degeneration. This case report has been reported in line with the SCARE Criteria [6].

2. Presentation of case

A 58-year-old hypertensive male patient was referred to our hospital for further evaluation of TBAD with aneurysmal degeneration. He has been complaining of back pain and was treated with ACE-inhibitor, beta-blocker, calcium antagonist, and statin. Careful evaluation of the aortic CT (Fig. 1) revealed multiple tears with the primary one being very large and located approximately 1.5 cm distal to the left subclavian artery (LSA) and the exit one near the superior mesenteric artery (SMA) (Fig. 1A). True lumen was much smaller than the false with the largest total diameter of more than 6 mm (Fig. 1B). All visceral branches flow were supplied from either true lumen or combination of true and false lumen (Fig. 1C, D). The dissection extended to the left iliac and femoral artery while the right ones are free from the dissection making them the preferred access vessel (Fig. 1E).

Under general anesthesia, TEVAR using percutaneous approach was

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performed by three experienced interventional cardiologists. After placing an 18F sheath (S&G biotech, Seoul, Korea) in the right common femoral artery, Terumo exchange wire (Terumo, Tokyo, Japan) was advanced to the aorta. Although we have tried several times with multiple catheters, the wire always went to the false lumen, probably through the exit tear near the superior mesenteric artery, followed the course of the false lumen of descending aorta and re-entered the true lumen through the primary entry tear just distal to the LSA before finally arrive at the ascending aorta (Fig. 2A). We were about to puncture the right brachial artery and put another wire from brachial artery to the aortic arch and follow the course of descending aortic true lumen as a guide to place the wire in the reverse direction. However, we came out with an idea of looping wire technique.

Shortly, the wire was advanced through the false to the true lumen above the entry tear in the proximal descending thoracic aorta, where angiography showed the true lumen entry point. It was then looped and directed antegradely into the true lumen all the way down to where the difficulty in tracking the wire into the true lumen was (Fig. 2B, C). The tip of wire then provided guidance and possibly some deformation to open the true lumen such that a second wire passed from the femoral access now passed easily into the true lumen all the way to the arch (Fig. 2D). Multiple small volume contrast injections were performed through multi-purpose catheter during advancement of the second wire to make sure the position in the true lumen. We then advanced a pigtail marker through the second wire and performed aortography which clearly showed the position in the true lumen (Fig. 2E). The back-up Myer stiff wire (Boston Scientific, USA) was then advanced through the pigtail and was then used to advance and deploy 32 × 180 mm Seal Thoracic stent graft (S&G biotech, Seoul, Korea). Although aortogram showed true lumen expansion, the proximal covered part of stent graft was somewhat too distal than the intended position, which is partially covering the LSA (Fig. 2F). However, we decided to stop the procedure because no endoleak was detected. Unfortunately, 3 months follow up CT scan showed that the stent graft may have migrated more distally causing type 1A endoleak and partial thrombosis of the false lumen (Fig. 3A). We decided then to do the proximal extension with 34 × 50 mm Seal Thoracic stent graft which partially covered LSA and completely sealed the endoleak (Fig. 3B, C). The patient was discharged 3 days post-operatively and returned to his hometown approximately 400 km from our center so the follow-up was performed in the local hospital. It is now difficult to get back to our center due to traveling restrictions during COVID-19 pandemic. However, he reported that he has no more back pain.

3. Discussion

Wiring the true lumen might be one of the most challenging steps during TEVAR of complicated TBAD. Several methods have been applied to facilitate the process including tracking the true lumen from right brachial or radial artery to descending aorta, the use of TOE, IVUS, and integrative CT-angiogram [7,8]. Tracking the true lumen from brachial or radial artery is relatively simple and effective method, however, additional vascular access may potentially increase the risk of vascular complication. TOE is also an excellent technique, however it can only be used to confirm the position of wire in the proximal or mid part of descending aorta. It might be less helpful in this case as the exit tear at which the wire always shifted from true lumen to false lumen is located at the distal part of the descending aorta.

IVUS has also been used for this purpose. The capability of recognizing the true and false lumen as well as tears made it an excellent method of imaging to guide the placement of wire and when available, it is the preferred technique [9]. However, the cost might be a concern especially in developing countries, where TEVAR itself is already considered very expensive. Although to the best of our knowledge integrated CT-angiography has not been used for this purpose, we think this technology could be used effectively.

The looping wire technique may serve as an alternative method of guiding the process of wiring the true lumen during complicated TEVAR.

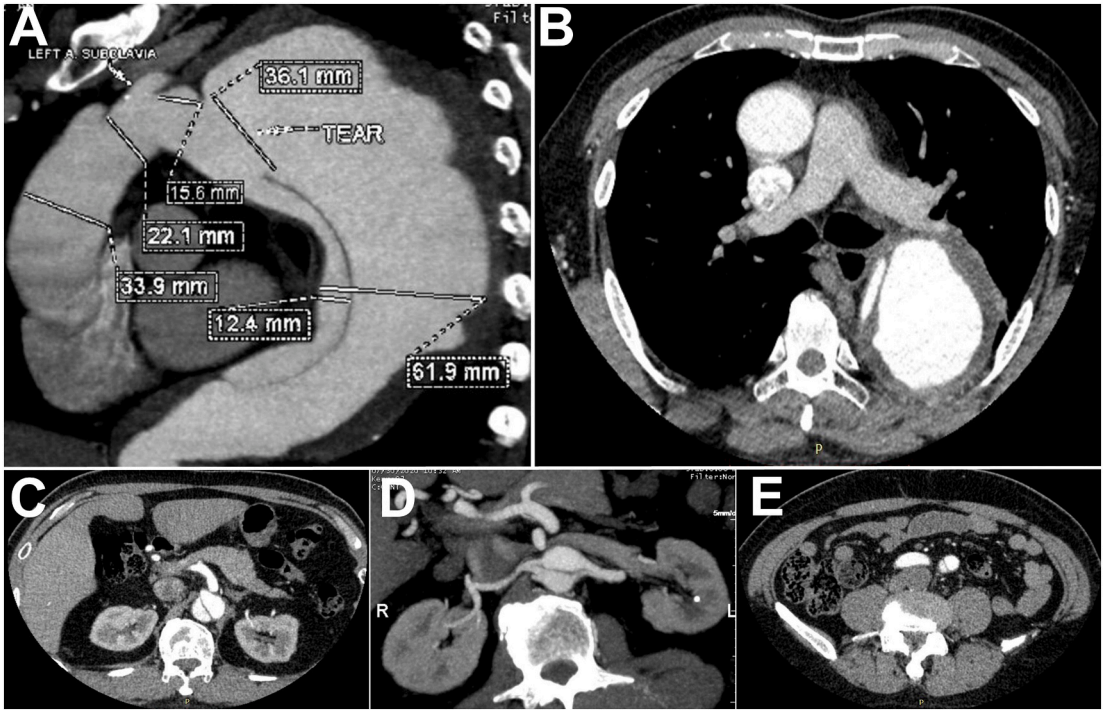

Fig. 1. Aortic CT of the patient.
A. Coronal view of the aortic CT, showing large false lumen and primary entry tear located 1.5 cm distal to Left Subclavian Artery. B. Axial CT view showing very large false lumen and very small true lumen. C, D. Visceral organs are supplied by either true lumen or combination of true and false lumen. E. The dissection involves the left but not the right iliac artery.

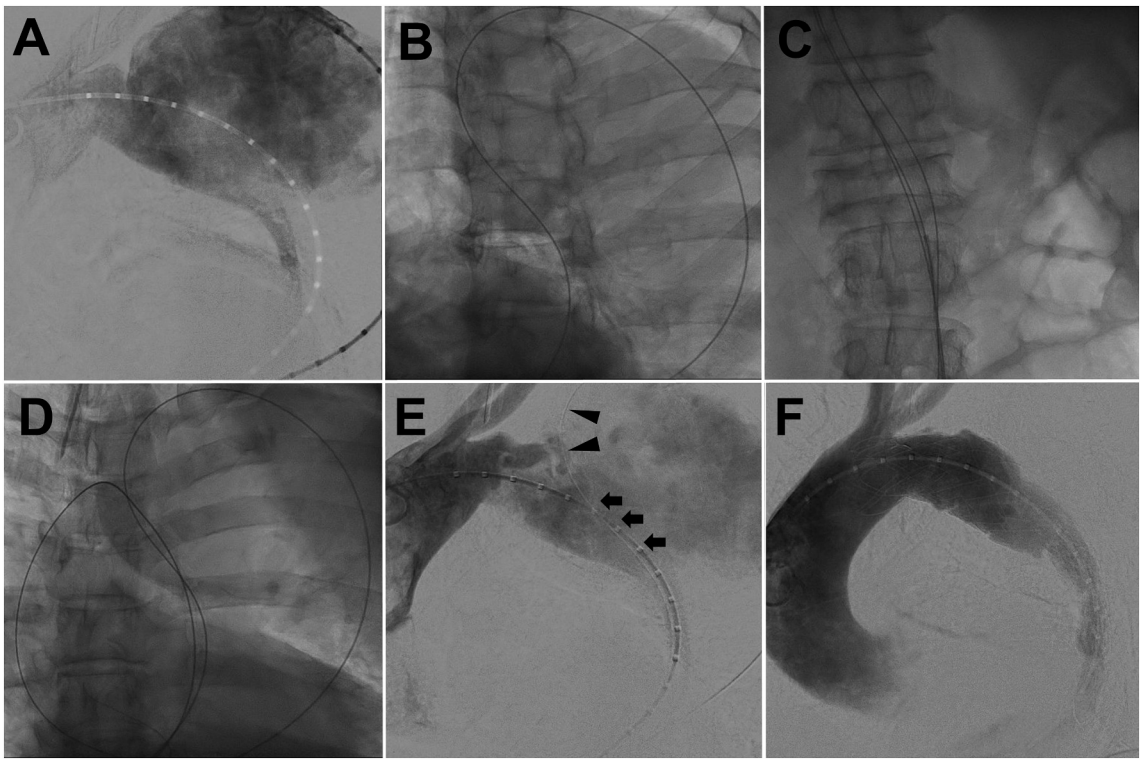

Fig. 2. Looping wire technique TEVAR.
A. Initial aortogram showing Type B Aortic dissection with large entry tear and large false lumen. The position of the pigtail at the descending aorta is clearly in the false lumen and went to the true lumen through the entry tear distal to the left subclavian artery. During the aortogram, the pigtail was pushed to the false lumen. B. Terumo exchange wire was looped from descending aortic false lumen to the descending aortic true lumen through the entry tear. C. The tip of the exchange wire cross path with the proximal part of the wire at the abdominal aorta, presumably at the level of exit tear near the SMA. Another wire was then advance with MP catheter following the track of the looped wire. D. Wire configuration after the second wire can be successfully advanced into the ascending aorta through the true lumen. E. Aortogram after the second wire can be advanced to the ascending aorta through the true lumen. Aortogram clearly showed the position of the looped wire and the catheter in the true lumen (arrows), while the proximal part of the wire was in the false lumen (arrowheads). F. Final aortogram after stent graft implantation showing complete exclusion of the false lumen.

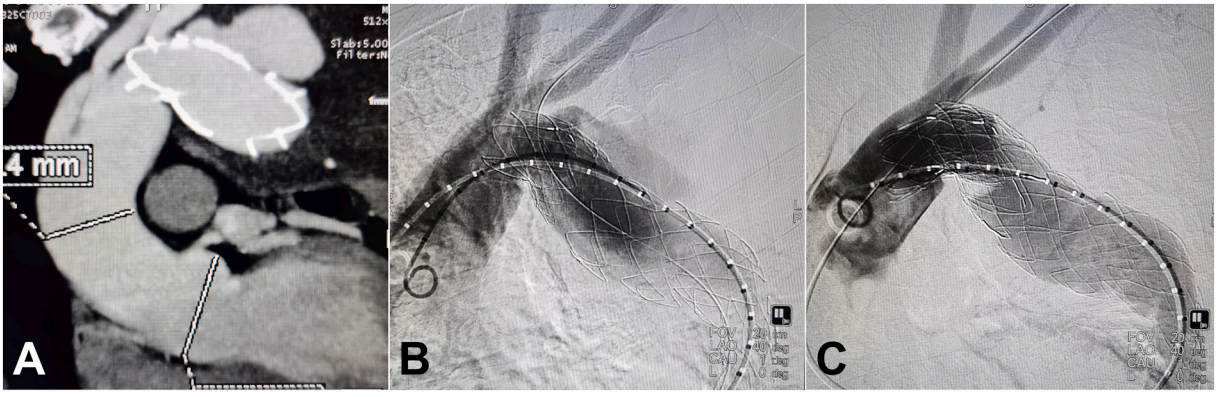

Fig. 3. 3 month follow-up CT and proximal extension graft.
A. Follow-up CT showing type 1A endoleak. B. Initial aortogram also showing type 1A endoleak. C. Final aortogram showing complete exclusion of the endoleak.

The wire that run through the descending true lumen did not only serve as a marker but might also change the course of the lumen that made it easier to direct the other wire into the true lumen. The technique is very simple and when the operator had the understanding of the aortic anatomy after evaluating the CT, it should be easy to perform. Additionally, it is considered very cheap as the only thing needed is just another wire. Finally, it can be performed from one access and thus potential complications from another vascular access can be avoided.

We think the technique is ideal in aortic dissection with the following anatomies: those with large proximal descending aorta and those with no additional tear between primary entry and exit tear. The large proximal descending aorta in this particular patient formed wide angulation that made it easier to direct the wire antegradely to the distal descending aorta. The absence of additional tears may ensure that the wire, after entering the true lumen from the false, stays in the true lumen until it crosses the exit tear.

In those with sharp angle maneuvers would be more difficult and might require directional catheters that may increase the risk of rupture. Although the technique does not guarantee that the wire has not traversed back and forth between true and false lumen, the potency can be

minimized by multiple contrast injections that ensure the position in the true lumen during the advancement of the second wire. In this patient entries were multiple, however none was located between the first tear near the LSA and the second tear near the SMA, thus the potential of traversing back and forth should be minimal. Even if it did happen, the effect might not be clinically significant since true-false-true deployment has been previously reported with good clinical outcome [4,10].

In summary, looping wire technique was successfully used to perform TEVAR in a patient with complicated TBAD in whom wiring of the true lumen was initially difficult.

4. Conclusion

Looping wire technique can be used as an alternative strategy to facilitate true lumen wiring in complicated TBAD.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Ethical approval

The institutional review board approved the writing and publication of this case report.

Consent

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Author contribution

Suko Adiarto: conception and study design, analysis and data interpretation, data collection, writing the manuscript, final approval.

Taofan Siddiq: analysis and data interpretation, data collection, critical revision, final approval.

Suci Indriani: analysis and data interpretation, data collection, critical revision, final approval.

Hananto Andriantoro: data collection, critical revision, final approval.

Iwan Dakota: data collection, critical revision, final approval.

Registration of research studies

Not applicable.

Guarantor

Suko Adiarto.

Provenance and peer review

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Declaration of competing interest

None.

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