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Case Report

Thoracic Endovascular Aortic Repair for Penetrating Aortic Ulcer in a Patient with Renal Failure: A Case Report

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Abstract

Thoracic Endovascular Aortic Repair (TEVAR) is a state-of-the art endovascular intervention used to treat various thoracic aortic pathologies such as aneurysm, dissection and penetrating aortic ulcers (PAU). The procedure demands significant technical skill and involves considerable cost burden for the patients. The latter is the main reason why the procedure has not yet made it to the routine clinical practice in Bangladesh. We recently performed TEVAR for the successful treatment of an ominous-looking PAU in the descending thoracic aorta in a patient with renal failure.

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Case report:

A sixty eight-year-old non-diabetic hypertensive female presented with sudden severe pain over her inter-scapular region that radiated towards the front of the chest. On physical examination, she was hemodynamically stable with a low-normal blood pressure and a regular heart rate and rhythm. There was no murmur and her lung fields were clear except the left lower zone where breath sound was diminished. Acute cardiac issues were excluded by electrocardiogram and Troponin I. Her subsequent work-up included a chest high-resolution computed tomographic (CT) scan of chest that revealed segmental collapse, consolidation, fibrosis and early bronchiectatic changes in posterior and medial basal segments of the lower left lung. Atherosclerotic changes with wall calcification were reported in the aortic arch and thoracic aorta. However, on careful image analysis, lung lesion was excluded and abnormality of descending thoracic aorta (DTA) was suspected. A CT aortogram of the thoraco-abdominal aorta was then performed which revealed focal rupture with intramural hematoma (IMH) in the proximal DTA (Figure 1. A, B) with mild left sided pleural effusion. Thrombus lining was seen along the wall of the adjacent thoracic aorta extending proximally up to the distal aortic arch. A diagnosis of ruptured penetrating aortic ulcer (PAU) with IMH was made and the patient was started on conservative management with a goal of aggressive blood pressure and pain control. A beta-blocker was added to her anti-hypertensive drug regimen.

The patient was a known case of chronic kidney disease for the last 10 years and has been on hemodialysis for the last 3 years through left Radio-Cephalic fistula. She had hypertension for the last 20 years which was not under consistent control. She suffered Covid-19 infection 2 months back and received the double-dose Oxford Astrageneca vaccine. She had no other major co-morbidities. Laboratory data was unremarkable except for raised serum creatinine and C-reactive protein, low hemoglobin and mild neutrophilic leukocytosis.

Though the patient remained hemodynamically stable and her back pain had subsided, Thoracic Endovascular Aortic Repair (TEVAR) was considered as a treatment option mainly because of the potentially catastrophic re-rupture of the

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PAU. Once informed consent was obtained from the patient party, CT images were sent for analysis for device customization. A 32X32X200 mm covered stent device mounted on a 22 Fr delivery system was selected.

The patient received hemodialysis the day before the TEVAR procedure. A cerebrospinal fluid (CSF) drainage and pressure monitoring system was inserted at the L3/4 interspace about 2 hours before the procedure. General anesthesia was then induced under endotracheal intubation. Longitudinal cut down was performed over the right groin and Common Femoral artery (CFA) control was taken. Patient was systemically heparinized with 5000 i.u. unfractionated heparin and diagnostic aortogram was performed using a 6F marker pigtail catheter from the left Femoral artery through a 6F sheath. Aortogram revealed a deeply punched out PAU in the proximal DTA which had increased in size compared with previous images and assumed a sharply pointed saccular configuration resembling a pseudoaneurysm (Figure 2). Longitudinal arteriotomy was performed in the right CFA. The device (Valiant Captivia, Medtronic Inc., USA) was prepared by flushing at the end and side ports and wiping with wet sponge. The device was then gently advanced sheathless over a super-stiff 0.038" Landerquist wire from the right CFA arteriotomy. Desired device position distal to the orifice of the left subclavian artery was confirmed by another aortogram using the marker pigtail parked at the proximal aorta. The device was then delivered under continuous fluoroscopic monitoring while maintaining a permissive hypotension. Post-deployment aortogram showed complete exclusion of the PAU without evidence of device migration or endoleakage (Figure 3). Right Femoral arteriotomy and groin cut-down wounds were closed, the patient was extubated and examined for any neurological event particularly paraplegia. The patient received hemodialysis after the procedure. Lower limb functions were monitored for the next 48 hours and since there was no deficit, CSF drainage catheter was removed. Amount of contrast used was 250 ml. Total blood loss was about 50 ml.

The patient recovered uneventfully in the post-operative period but complained headache of mild to moderate intensity that was worse on standing. The headache was managed with hydration and Paracetamol. Mild leukocytosis was seen in the 3rd post-operative day. A CT scan was performed on the 3rd post-operative day which confirmed exclusion of the PAU without evidence of device migration or endoleakage (Figure 4). The patient was discharged on the 4th post-operative day in stable condition.

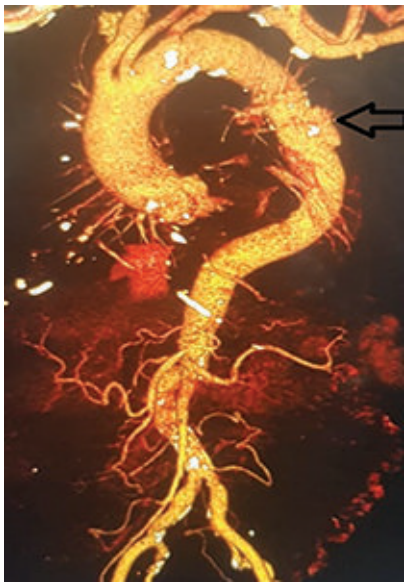

Fig.-1: CT aortogram showing penetrating ulcer in the proximal descending thoracic aorta.

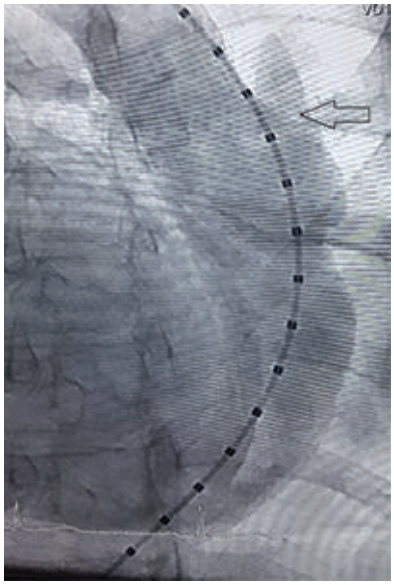

Fig.-2: *Intraoperative aortogram showing penetrating ulcer in the descending thoracic aorta.*

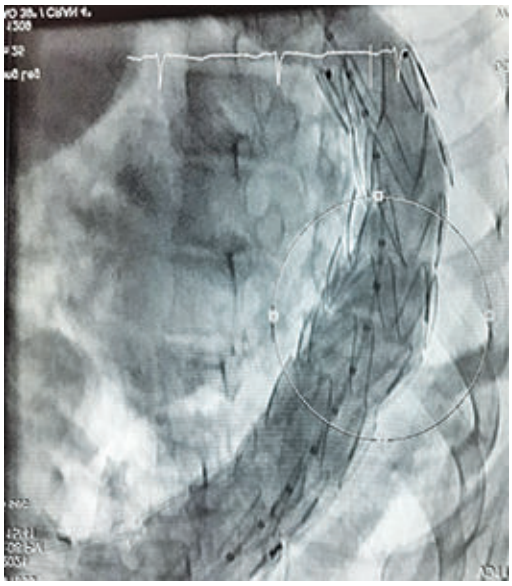

Fig.-3: *Post-procedural aortogram showing exclusion of penetrating ulcer in the descending thoracic aorta.*

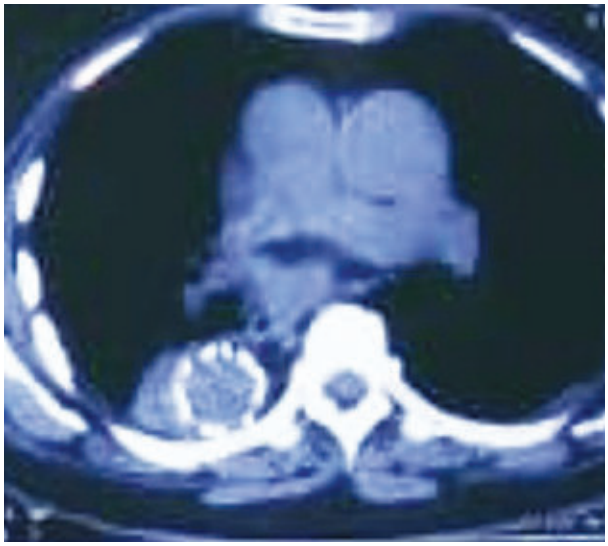

Fig.-4: *CT scan on the 3rd post-operative day confirms complete exclusion of aortic ulcer.*

Discussion:

Penetrating aortic ulcer, also called penetrating atherosclerotic ulcer, commonly involves the DTA.[1] Together with aortic dissection (AD) and IMH, it forms the entity described in modern literature as acute aortic syndrome (AAS).[2] Though the 3 conditions are also considered spectrum of the same disease, PAUs are sometimes considered a separate entity from AD because of the absence of an intimal flap.[1-3] PAUs can lead to AD and IMH but it's not always the case.[1,3] Though the true incidence of PAU is unclear, 7.6% of patients admitted with acute AD were found to be having PAU and were suggested to be the cause of dissection.[1] Other epidemiological studies suggest that the incidence of AD is 2.6-3.5% per 1,00,000 person/year and approximately 1 in 8 patients diagnosed with acute AD suffer from either IMH or PAU.[4,5] It is more common in aged male patients with hypertension and atherosclerosis. Pathophysiological studies indicate that PAUs are atherosclerotic lesions with ulceration that penetrate the internal elastic lamina and allows hematoma formation within the medial layer of the aortic wall.[6]

Clinical presentation of PAU may be variable with symptoms such as abdominal pain, shortness of breath, sweating, weakness, arm or leg pain resembling AD or aneurysm. However, back or inter-scapular pain of sudden onset with anterior chest radiation is a typical symptom. Presentation in our case was similar to that described by Chong et al.[7] Imaging is a key aspect in the diagnosis of PAU with or without IMH. It is also instrumental for precise device customization. The present case is an example of how diagnosis can be elusive if image analysis is not meticulous. Report of the chest CT scan initially suggested collapse consolidation of the left lung rather than aortic pathology, a notion that was dispelled by subsequent image analysis. This highlights the importance of dedicated radiology expertise in the field aortic diseases with a focus on endovascular interventions. Clinical correlation is important and should be considered during image analysis.

Indication for intervention for thoracic aortic PAU and IMH has been a matter of some contention. The advent of TEVAR as a minimally invasive treatment option has greatly influenced the principles in this regard. PAUs and IMH in the DTA that remain asymptomatic on conservative management may be followed-up with serial imaging. However, indication for intervention is strong in those with on-going symptoms and in case of rupture or pseudoaneurysm formation.[2,3] Janosi et al. described their experience in a large series of PAU where both symptomatic and asymptomatic patients underwent TEVAR.[8] D'

Souza et al. also reported on a similar series of TEVAR for PAU where contained rupture was one of the indications.[9] Our patient presented with focal rupture of the DTA and therefore had a strong indication for intervention. Size of PAU has been correlated with the risk of mortality. Janosi et al. found a diameter of more than 15 mm to be an independent predictor for mortality. Lesion in the present case not only had significantly increased in size but also obtained a sharply pointed saccular morphology in a matter of 3 weeks justifying an emergent procedure.

Paraplegia is a dreaded complication of TEVAR occurring in up to 13% of patients.[10] Device length with extent of distal coverage in the area between D10-L1, low peri-procedural mean arterial pressure, high CSF pressure etc. are considered as main risk factors. Avoiding coverage of the *Arteria Radicularis Magna* or *Artery of Adamkiewicz* is often discussed as a precautionary measure. However, it is logical to think that in aged patients with extensive atherosclerosis, many intercostal arteries are already thrombosed and spinal cord blood supply is hardly dependent on a single major artery and is derived from multiple sources through extensive collateralization that occur over time. In reality, the preoperative mapping of the *Artery of Adamkiewicz* is not always practiced, rather proactive precautionary measures such as CSF drainage and pressure monitoring, hypothermia, maintaining optimum mean arterial pressure and using the shortest possible device length have led to a steady decline in the incidence of paraplegia over the years.[11] We employed all of the above precautionary measures except device length which could not be precisely customized because of the lack of availability. However, due to a wide aortic arch curvature, tortuosity of the DTA and relatively proximal origin of the arch vessels, the distal end of the 200 mm long device landed above the D10 level and there was no neurological consequences.

EVAR and TEVAR are not routinely practiced in Bangladesh. The main obstacle that stands in the way is affordability. Bangladesh being a middle-income country, the device cost is beyond the financial capability of majority of the patients. Lack of any insurance coverage makes it even more difficult for the patients. Another obstacle is the unavailability of hybrid vascular catheterization laboratory wherein the procedure is ideally performed. In the absence of such facilities, we performed TEVAR in the present case in a regular cardiac catheterization laboratory making surgical facilities available therein. Given the circumstances, only a few cases have been possible so far where indication was thoracic or abdominal aortic aneurysm.[12] It is for the first time that TEVAR has been done for PAU with IMH. The present case is an example of how TEVAR or EVAR can be a potentially life-saving procedure highlighting the immediate need for development of this state-of-the art vascular intervention in Bangladesh.

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Conflict of Interest - None.

References:

1. Sundt T. Intramural Hematoma and Penetrating Atherosclerotic Ulcer of the Aorta. *Ann Thorac Surg*. 2007; 83(2): S835-S841. DOI:10.1016/j.athoracsur.2006.11.019
2. Corvera J. Acute aortic syndrome. *Ann Cardiothorac Surg*. 2016; 5(4): 188-193. DOI:10.21037/acs.2016.04.05
3. Eggebrecht H, Plicht B, Kahlert P, Erbel R. Intramural Hematoma and Penetrating Ulcers: Indications to Endovascular Treatment. *Eur J Vasc Endovasc Surg*. 2009; 38(6): 659-665. DOI:10.1016/j.ejvs.2009.09.001
4. Reed N, Oderich G. Penetrating Aortic Ulcer and Intramural Hematoma. *Decker Med Vascular and Endovascular Surgery*. 2015. DOI:10.2310/vasc.3015
5. Akin I, Kische S, Ince H, Nienaber C. Penetrating aortic ulcer, intramural hematoma, acute aortic syndrome: when to do what. *J Cardiovasc Surg (Torino)*. 2012; 53(1 Suppl 1): 83-90.
6. Coady M, Rizzo J, Elefteriades J. Pathologic Variants Of Thoracic Aortic Dissections. *Cardiol Clin*. 1999;17(4):637-657. DOI:10.1016/s0733-8651(05)70106-5
7. Stanson A, Kazmier F, Hollier L et al. Penetrating atherosclerotic ulcers of the thoracic aorta: natural history and clinicopathologic correlations. *Ann Vasc*

Surg. 1986;1(1):15-23. DOI:10.1016/s0890-5096(06)60697-3

8. Chong F, Winter M, Puckridge P, Penhall A, Joseph M. A Rare Case of Penetrating Atherosclerotic Ulcer of the Aorta. *Heart, Lung and Circulation*. 2012; 21(2):105-107. DOI:10.1016/j.hlc.2011.08.068
9. Jánosi R, Gorla R, Tsagakis K et al. Thoracic Endovascular Repair of Complicated Penetrating Aortic Ulcer. *J Endovasc Ther*. 2015; 23(1):150-159. DOI:10.1177/1526602815613790
10. D'Souza S, Duncan A, Aguila F et al. TEVAR for non-aneurysmal thoracic aortic pathology. *Catheter Cardiovasc Interv*. 2009; 74(5): 783-786. DOI:10.1002/ccd.22123
11. Rizvi A, Sullivan T. Incidence, prevention, and management in spinal cord protection during TEVAR. *J Vasc Surg*. 2010; 52(4): 86S-90S. DOI:10.1016/j.jvs.2010.06.148
12. Bobadilla J, Wynn M, Tefera G, Acher C. Low incidence of paraplegia after thoracic endovascular aneurysm repair with proactive spinal cord protective protocols. *J Vasc Surg*. 2013; 57(6): 1537-1542. DOI:10.1016/j.jvs.2012.12.032
13. Hossain G, Bashar A, Hakim M et al. Thoracic Endovascular Aortic Repair (TEVAR): A Case Report. *Bangladesh Heart Journal*. 2019; 34(2): 146-150. DOI:10.3329/bhj.v34i2.44447