A LARGE PARADIGM SHIFT LEADS TO A SMALL KEYHOLE PUNCTURE: A CASE STUDY OF THORACIC ENDOVASCULAR AORTIC REPAIR (TEVAR) FOR DISTAL AORTIC ARCH PSEUDOANEURYSM IN A PATIENT WITH SEVERAL SEVERE UNDERLYING MEDICAL CONDITIONS

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ABSTRACT

This case study highlights how far aortic surgical intervention has come along since the advent of open aortic repair in the 1950s to the monumental introduction of minimally invasive endovascular aortic repair in mid-1990s.

The following case depicts a successful management of distal aortic arch pseudo aneurysm with Thoracic Endovascular Aortic Repair (TEVAR) along with carotid-carotid bypass in an elderly gentleman with multiple severe underlying medical conditions - including left papillary renal cell carcinoma (RCC), toxic nodular goiter, and hypertension.

The subsequent presentation will highlight chronological management of this case across the timeline with the varying advancements of aortic repair from no intervention to open repair, and now with TEVAR.

The management of this case also highlights the importance of involving a multidisciplinary team approach to provide a holistic co-management for this patient.

Keywords: Distal aortic arch, pseudoaneurysm, aortic surgery, TEVAR, carotid-carotid bypass, open aortic repair, multidisciplinary approach, multiple co-morbidities

INTRODUCTION:

This case study presents the successful management of a distal aortic arch pseudoaneurysm with thoracic endovascular aortic repair (TEVAR) in a patient with other grave underlyings of left papillary renal cell carcinoma (RCC), toxic nodular goiter, and hypertension. Conventionally, a patient with pseudoaneurysm undergoes open repair. Open aortic repair carries with it a high risk of morbidity and mortality, which may include but is not limited to infection, stroke, massive bleeding, and death [1]. Because of this worrying number, an open aortic repair is risky, especially if the patient has other debilitating co-morbidities.

With the advent of TEVAR in the 90's, the data appears more and more hopeful for both surgeons and patients as the advancement of TEVAR makes the procedure easier and the prognosis more guarded [2]. In view of this patient's multiple severe co-morbidities, a cautious approach was considered and TEVAR was considered as a best choice for repair.

This case highlights the prompt recognition, careful management and successful resolution of the pseudoaneurysm while considering the patient's overall clinical profile. This was achieved through a multidisciplinary approach.

CASE REPORT:

This case looks at a 69-year-old gentleman, presented with symptoms of general lethargy and occasional dyspnea. His medical history was notable for left exophytic papillary RCC measuring 6x5x8cm, toxic nodular goiter with local mass effect to trachea, and hypertension. During the staging workup for RCC, a computed tomography (CT) aortogram (CTA) incidentally revealed a distal aortic arch outpouching with penetrating aortic ulcer (PAU) and no haematoma - measuring approximately 4.1x1.5cm, located 2.8cm distal to the left subclavian artery. Cardiomegaly and pulmonary arterial hypertension (PAH) were observed as secondary effects of the pseudoaneurysm (Figure 1 and 2). Considering the patient's multiple debilitating underlying medical conditions, careful consideration was given in the management approach. A multidisciplinary team (MDT) involving cardiovascular surgery, urology, and surgical endocrinology was assembled to optimize patient care. Given the perilous risks associated with open surgery, the decision was made to proceed with minimally invasive TEVAR first, and subsequently for surgical resection of the RCC. At the same time, the medical endocrine team was managing the toxic nodular goitre with Carbimazole first and subsequently planned for total thyroidectomy as there was mass effect affecting the trachea from the CT scan. From Cardiovascular surgical side, TEVAR and carotid-carotid bypass under general anesthesia to address the distal aortic arch pseudoaneurysm was decided after discussion by the surgical team and endovascular device team. TEVAR was still offered here instead of open surgery for several advantages, including minimally invasive access, reduced operative trauma, and shorter recovery time, which were all particularly beneficial considering the patient's underlying morbidities. In the same setting, a carotid-carotid artery bypass grafting was done to provide adequate circulation to the left carotid artery from the right carotid artery. TEVAR planning and assessment was done by the device team (Figure 3). During the surgery, the carotid-carotid bypass was carried out first with dacron graft tube. Subsequently, TEVAR was placed under imaging guidance. The landing zone was just distal to the inominate artery.

Following the TEVAR procedure, the patient was closely monitored in the cardiac intensive care unit (CICU) for one day to ensure postoperative stability (Figure 4 and 5). The patient exhibited a favorable recovery and was subsequently discharged well on the second day post TEVAR.

Following TEVAR, subsequent follow up in the outpatient clinic showed that the other relevant teams involved taking advantage of TEVAR by proceeding with their subsequent respective managements. The urology team proceeded with robotic left Nephrectomy 1 month after the TEVAR, and patient's toxic nodular goiter was well managed by the endocrinology team and planned for a total thyroidectomy down the road, following the successful resolution of the aortic pseudoaneurysm with TEVAR.

DISCUSSION:

This case highlights the successful application of TEVAR in a complex case of pseudoaneurysm. Distal aortic arch pseudoaneurysm, also known as false aneurysms, occurs when there is a breach in the arterial wall, resulting in the formation of a sac that is partially contained by surrounding tissues [3]. Aortic pseudoaneurysms can develop due to trauma, infection, or as a complication of previous surgical interventions. It is associated with significant morbidity and mortality up to 85% [4].

Thoracic endovascular aortic repair (TEVAR) is a minimally invasive surgical procedure for the management of an array of thoracic aortic pathologies such as aortic aneurysm, aortic dissection, penetrating ulcers, intramural haematoma and pseudoaneurysm. It involves the insertion of a stent graft through small incisions in the groin area, which is guided to the site of the pseudoaneurysm using fluoroscopy or computed tomography (CT) scan. The stent graft is expanded once in position, creating a new path for blood flow and effectively excluding the pseudoaneurysm from the circulation. The stent graft acts as a reinforcement for the weakened or damaged arterial wall, preventing further expansion and reducing the risk of rupture.

The utilization of TEVAR as a less invasive intervention allowed for the effective treatment of the distal aortic arch pseudoaneurysm. TEVAR also minimizes the morbid risks from 10-20% associated with open surgery, to 5-10% with TEVAR [5-9].

The application of TEVAR results in smaller incisions, reduced blood loss, and shorter recovery times [6]. It is generally associated with better patient outcomes. However, David et al indicated that although operative mortality was indeed halved with stent graft, late survival was similar for both cohorts (stent vs open surgery), with identical re-intervention rate and rate of spinal cord ischaemic complication, and a higher risk of stroke (6% in surgery vs 12% in stent) [9].

Hence, TEVAR may prove to be the favored choice of repair for thoracic aorta cases such as in this patient, but TEVAR still imposes certain risks and therefore more research needs to be done to explore the long-term effect of TEVAR.

A carotid-carotid bypass was done in this case to provide blood supply to the left carotid artery as the TEVAR was deployed just at the distal to the innominate artery. Although a conventional approach of carotid-carotid artery bypass and left carotid-left subclavian artery bypass was recommended by the endovascular device team, the surgeon deemed that the left subclavian artery system will be adequately perfused via the vertebral artery and hence did not proceed with the left carotid-left subclavian artery bypass in this case. Edward Y. Woo shared a similar view after a retrospective analysis was done in his center when he stated that "Zone 2 TEVAR with LSA coverage can be accomplished safely in both elective and emergency settings and with and without revascularization (with the exception of a patent LIMA-LAD bypass)" [8].

Lastly, it is also important to emphasize the marvel of multidisciplinary input in this case as each team was able to delineate their individual plan for the patient, and a collective decision was made for the best interest of this patient. All the while treating each debilitating diseases which the patient suffers, and at the same time addressing the treatment holistically treating the patient.

CONCLUSION:
In this case study, TEVAR proved to be a significant beneficial treatment modality for a distal aortic arch pseudoaneurysm in a patient with multiple severe underlying medical conditions. The minimally invasive nature of TEVAR, combined with careful multidisciplinary management, facilitated successful resolution of the pseudoaneurysm while considering the patient's complex medical profile. This case emphasizes the importance of tailoring treatment approaches to the individual patient and highlights the benefits of a collaborative and sequential management strategy.

DATA AVAILABILITY:
Further information regarding the data used for this work can be obtained from the corresponding author upon reasonable request.

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This work received no external funding.

CONFLICT OF INTEREST:
The authors have no conflicts of interest to declare and is in agreement with the contents of the manuscript.

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FIGURE LEGENDS:

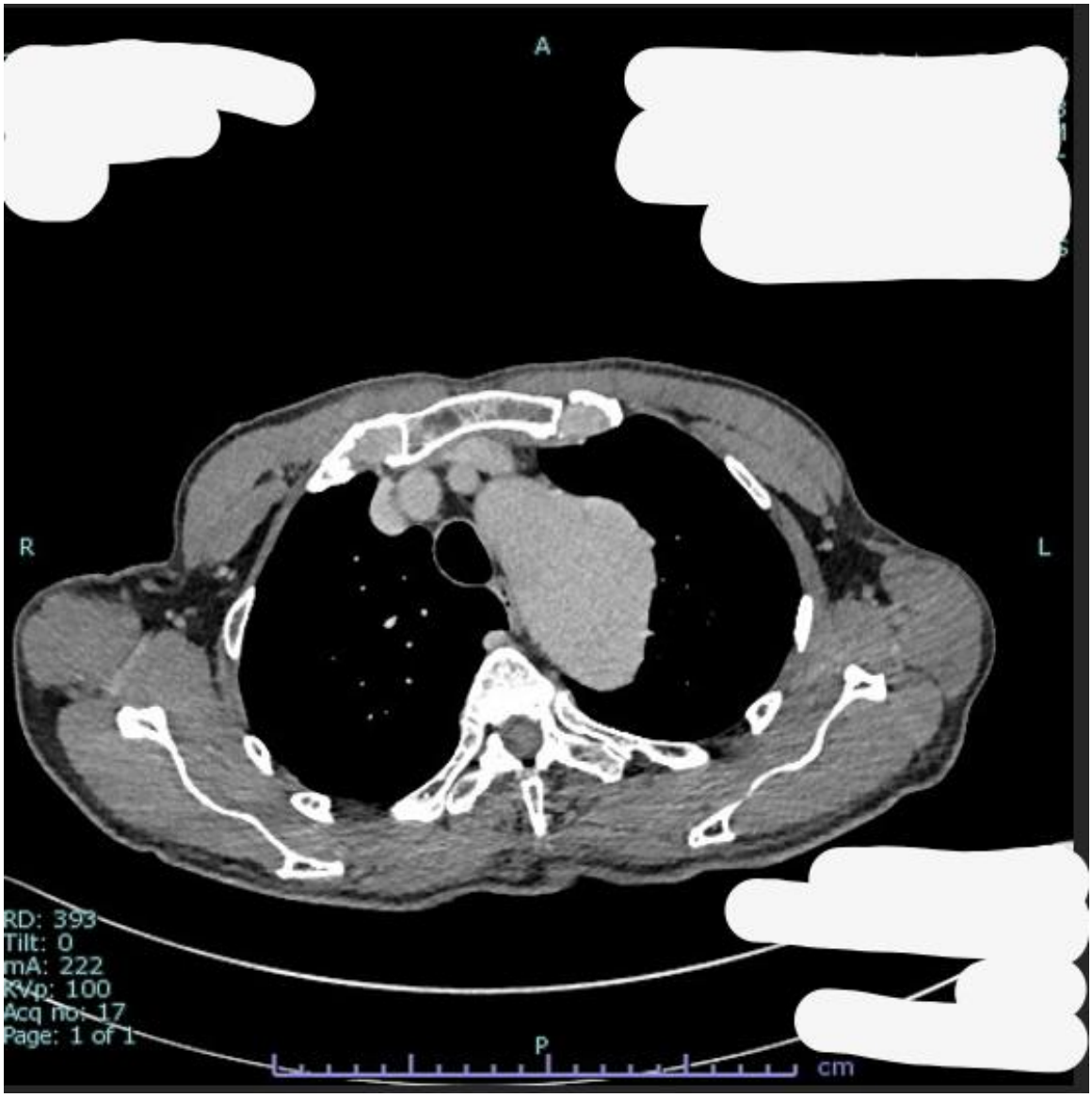

Figure 1: Axial view of CTA showing the pseudoaneurysm in the distal aortic arch.

Figure 2: Coronal view of the CTA showing the pseudoaneurysm outpouching of distal aortic arch.

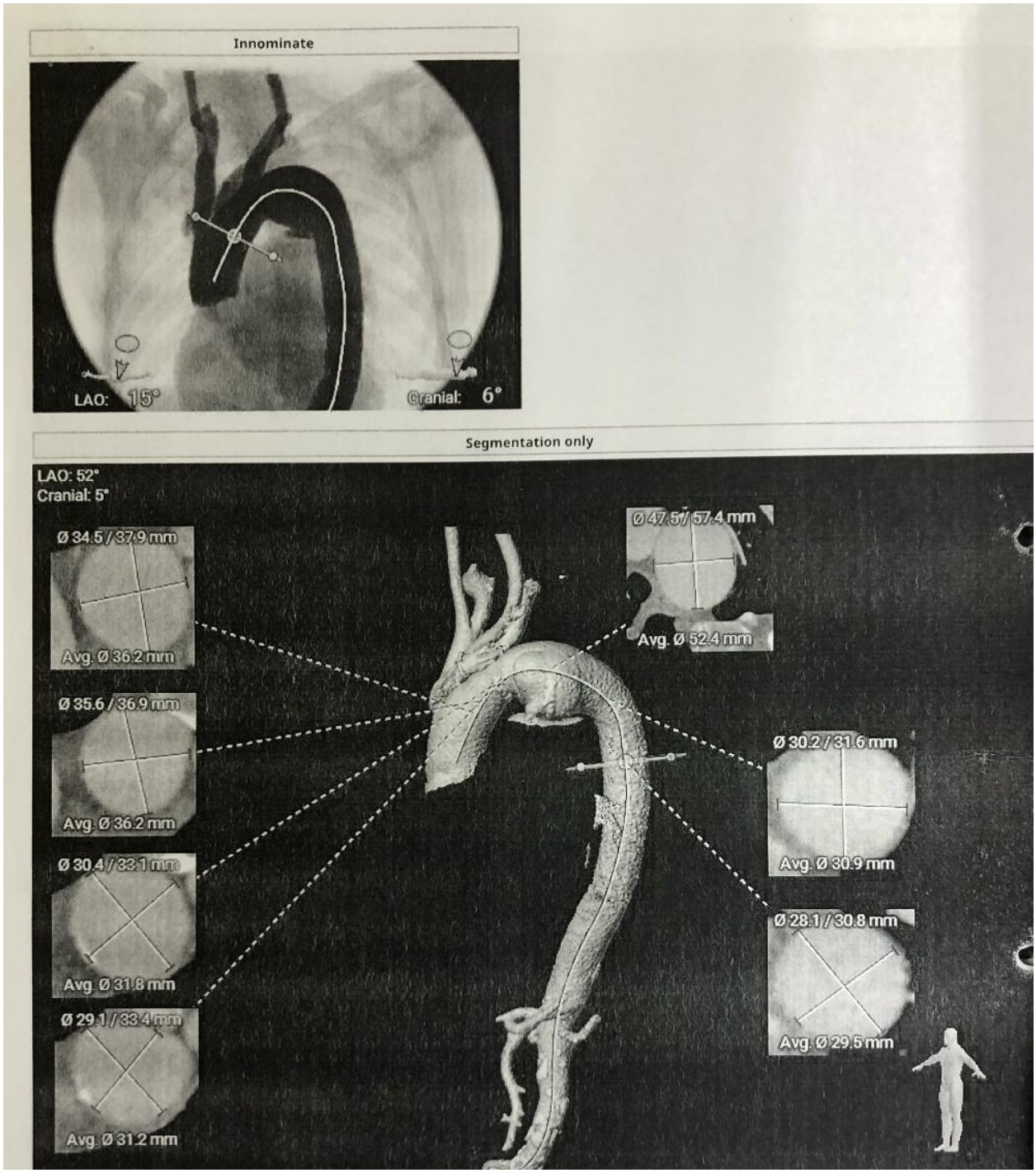

Figure 3: TEVAR Planning.

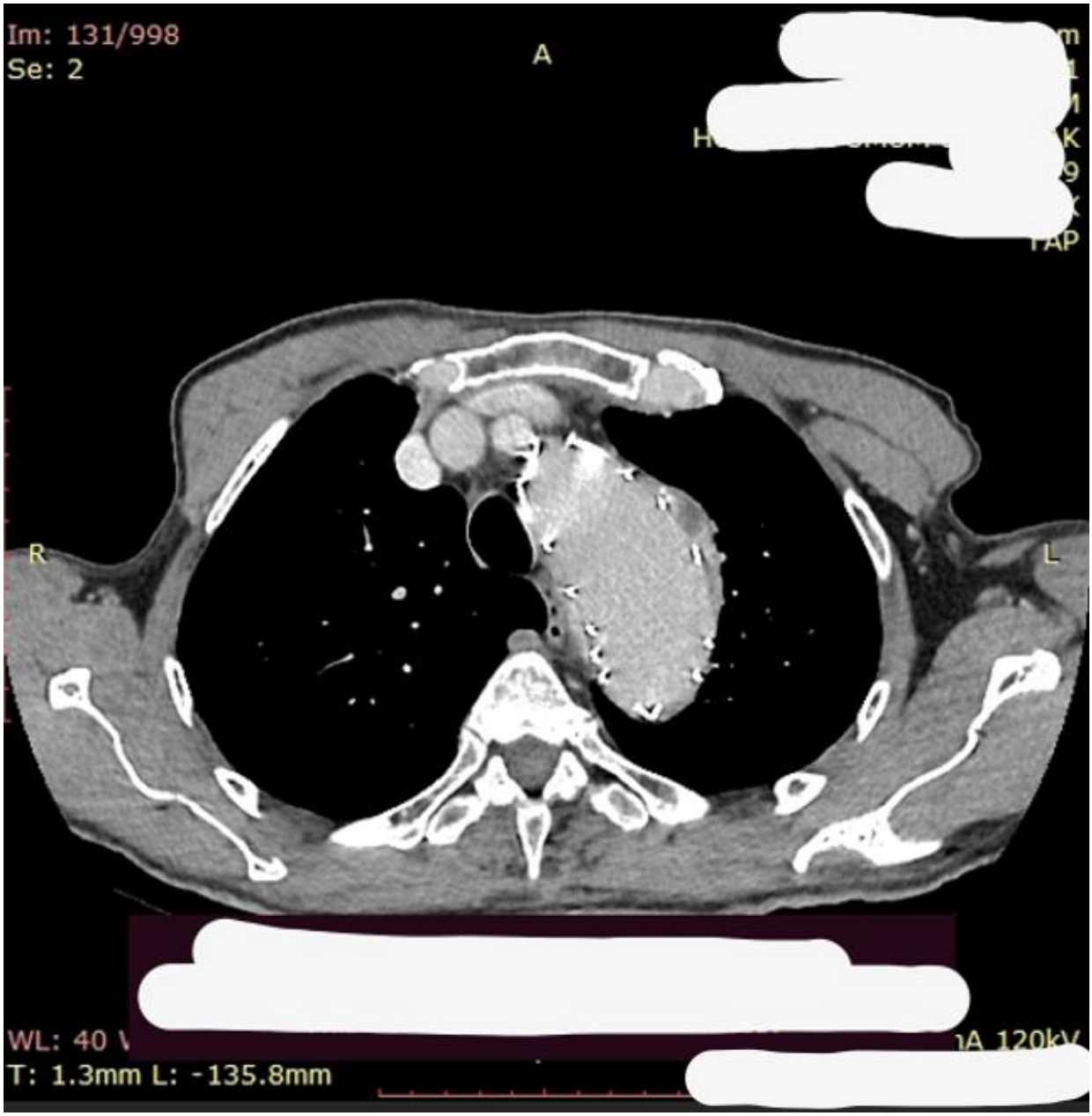

Figure 4: Axial view of CTA post TEVAR.

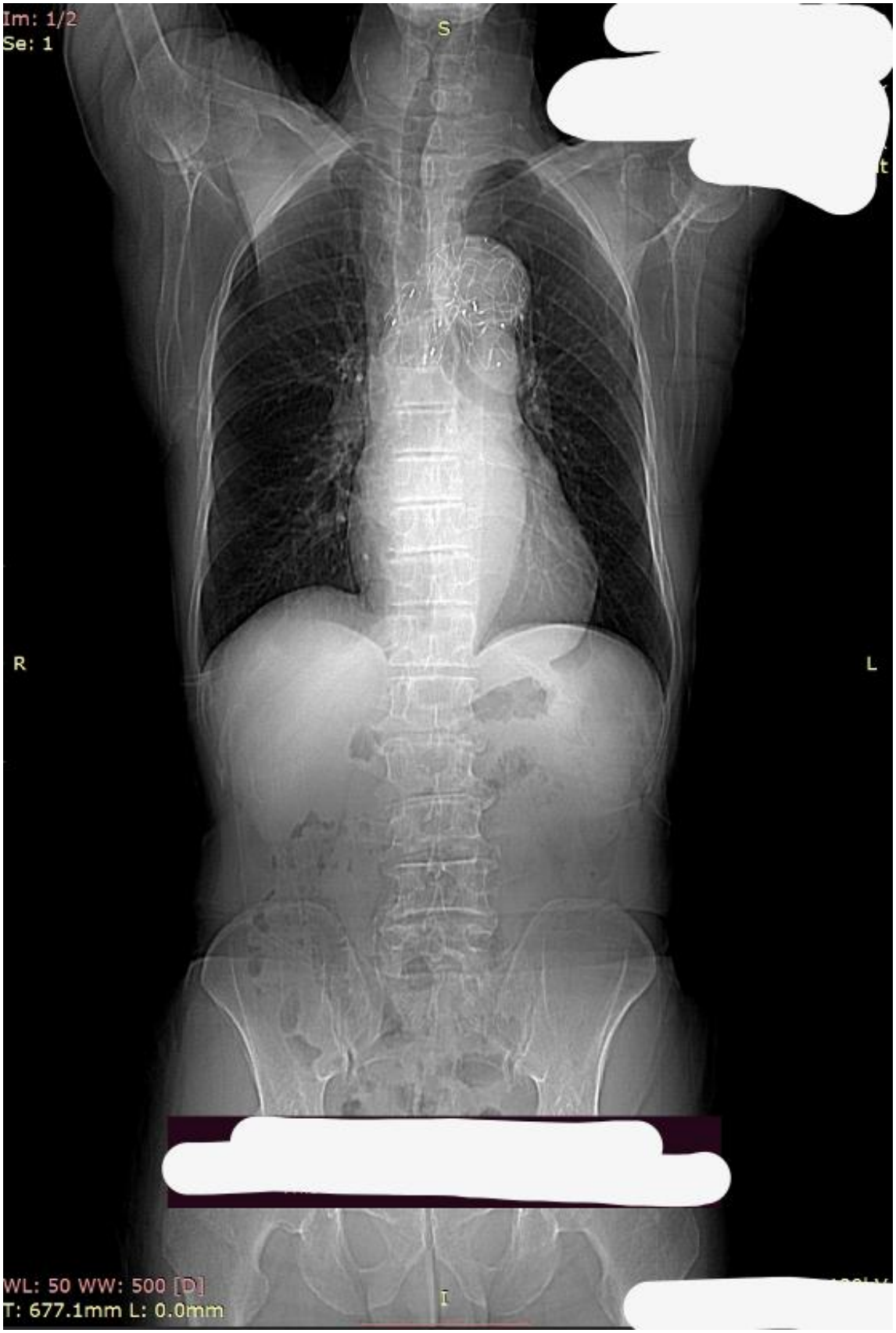

Figure 1 : Coronal view of CTA post TEVAR.