



# Is Left Innominate Vein Ligation during Aortic Arch Surgery Always Safe? A Case Report

Nikolaos Schizas, MD, MSc, PhD(c)<sup>1\*</sup>, Vasilios Patris, MD, MSc, PhD<sup>1</sup>, Ilias Samiotis, MD, MSc, PhD<sup>1</sup>, Eleni Nikoli, MD<sup>2</sup>, Niki Lama, MD, PhD<sup>3</sup>, Michail Argiriou, MD, MSc, PhD<sup>1</sup>

<sup>1</sup>Department of Cardio Thoracic and Vascular Surgery, Evangelismos General Hospital of Athens, Athens, Greece.

<sup>2</sup>Department of Anesthesiology, Evangelismos General Hospital of Athens, Athens, Greece.

<sup>3</sup>Research Unit of Radiology and Medical Imaging, Kapodistrian University of Athens, Athens, Greece.

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## Abstract

Ligation of the left innominate vein (LIV) expands the surgeon's surgical field for ascending aorta and aortic arch procedures. Although it is considered a safe technique by most surgeons in that it is associated with only minor drawbacks, conflicting views exist regarding this method. We herein describe a 70-year-old woman who underwent ascending aorta replacement due to an aneurysm with subsequent cerebral dysfunction caused by extended brain edema, possibly related to LIV ligation, leading to her death.

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## Introduction

Optimal zone selection for distal anastomosis in ascending aorta replacement requires adequate exposure of the aortic arch. The simple retraction of the left innominate vein (LIV) does not always provide the best exposure and often causes injury to the vein, necessitating management. The ligation of LIV is routine practice for some surgeons; however, there are conflicting views on this method.

In this article, we describe a 70-year-old woman who underwent ascending aorta replacement due to an aneurysm with subsequent cerebral dysfunction caused by extended brain edema.

## Case Report

A 70-year-old woman was admitted to our department with an ascending aorta aneurysm (85×50 mm) for surgical restoration (Figure 1).

The intraoperative findings suggested that the cannulation of the innominate artery was the better option for maintaining adequate antegrade cerebral perfusion while the venous cannula was placed typically in the right atrium. The division and ligation of

LIV was inevitable. Ascending aorta replacement was performed while the total circulatory arrest was avoided. The cardiopulmonary bypass time was 75 minutes, and the cross-

\*Corresponding Author: Schizas Nikolaos, Department of Cardiovascular and Thoracic Surgery, Evangelismos General Hospital, Athens, Ypsilantou 45-47, Greece. 10676. Tel: +30 6936820715. E-mail: nikschiyas@gmail.com.





clamp time was 45 minutes. Weaning from the extracorporeal circulation was uneventful.

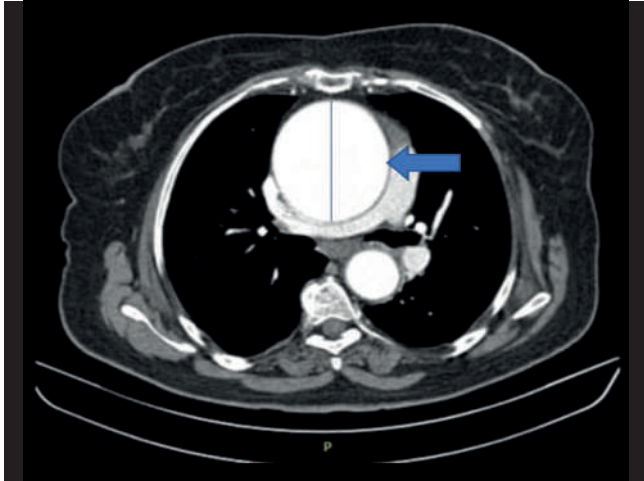


Figure 1. The vertical view on computed tomography angiography (blue arrow) illustrates an 85×80 mm aneurysm in the ascending aorta. The diameter of the aneurysm is shown by the blue line.

At the intensive care unit, the patient could not be weaned from the ventilator because of neurocognitive dysfunction. A brain computed tomography (CT) scan revealed diffuse bilateral cerebral edema that displaced the cerebral stem without signs of ischemic lesions or brain hemorrhage (Figure 2). Swelling of the face, tongue, and left upper limb was also present. The left upper limb edema was managed by elevating the upper extremity. The administration of diuretics, cortisone, and mannitol failed to reduce the edema according to a repeated brain CT scan.

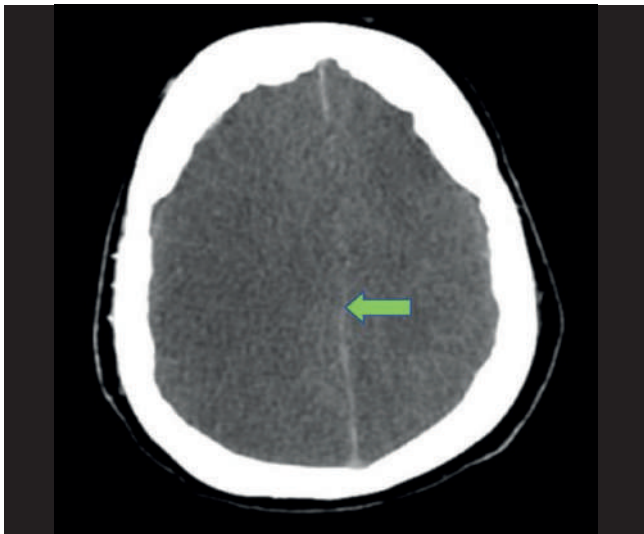


Figure 2. The image depicts diffuse cerebral edema that displaces the cerebral stem without signs of ischemic lesions or brain hemorrhage. (The green arrow shows the misalignment of the midline, vertical view in brain computed tomography scanning.)

A triplex ultrasound examination of the venous and arterial systems of the neck and great vessels showed that the right internal jugular vein was almost totally occluded by a thrombus that provoked external pressure just above the right innominate vein, while the carotids were normal (Figure 3). For the thrombosis, low molecular weight heparin was administered systemically.

The patient's clinical condition showed no improvement in the following days, and she died on the ninth postoperative day.

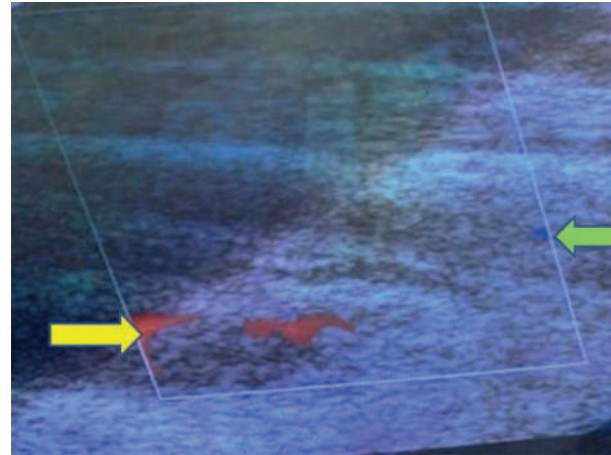


Figure 3. The image depicts the triplex ultrasound examination of the neck vessels. The red color shows the internal and external carotids (the yellow arrow), while the blue color shows the right internal jugular vein (the green arrow). The venous return flow (blue) from the internal jugular vein is almost occluded with minimal flow.

## Discussion

The vein drainage of a divided LIV is usually restored via the azygos and hemiazygos systems, the lateral thoracic and superficial thoracoabdominal veins, the internal mammary veins, and the vertebral plexus.<sup>1</sup> Alternatively, the blood flow of the left subclavian vein is canalized through the left internal jugular vein to the confluent sinus. Subsequently, it is directed through the right internal jugular vein to the superior vena cava and the right atrium.<sup>2</sup>

LIV ligation is common practice in aortic arch surgeries. The localization of the aneurysm prompted us to cannulate the innominate artery in that it offers a simplified and improved antegrade cerebral perfusion, according to DiBartolomeo.<sup>3</sup> The ligation of LIV is performed in some cases for anatomical reasons to facilitate aortic arch exposure and is considered a safe method without major complications.

The ligation of the innominate vein is accompanied by moderate symptoms such as edema of the upper limbs and swelling of the head and neck. Such cases are treated with conservative management.<sup>4</sup> Although the literature abounds with cases featuring unilateral brain edema in association with



the hyperperfusion syndrome of reversible encephalopathy,<sup>5</sup> we strongly believe that our patient's unilateral brain edema was provoked by an insufficient venous return.

Our concerns were centered on the impaired venous return from the arm and the brain, as well as the potential consequences of venous hypertension in the arm and brain. The absence of ischemic lesions and the findings of the triplex ultrasound examination, while taking into consideration the failed efforts to perform central jugular catheterization, were related to the development of extended diffuse brain edema, which could not be absorbed as a consequence of the diminished flow of the externally obstructed right internal jugular vein.

## ***Conclusion***

In our opinion, the clinical suspicion of a contralateral internal jugular vein obstruction warrants an intraoperative ultrasound examination. If the findings indicate a possible insufficient venous return from the right innominate vein, then LIV reconstruction, which is a safe option, may be necessary.

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