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Case Report

An unusual cause of high-output heart failure from the iliac arteriovenous fistula after lumbar discectomy: A case report ☆

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ABSTRACT

A minority of patients with heart failure present in a high-output state. We described an uncommon case of high-output heart failure caused by an iliac arteriovenous fistula (IAVF), a rare but serious complication after lumbar discectomy surgery (LDS). A 44-year-old man with no notable medical condition except a history of herniated nucleus pulposus necessitating the L4-L5 LDS 5 years ago presented with clinical signs of progressive high-output heart failure. Physical examination revealed wide pulse pressure with bruit and systolic thrill at the right inguinal region. Computed tomographic angiography confirmed the IAVF from the right common iliac artery to the left common iliac vein. There was a significant shunting to the venous system, causing severe dilatation of the inferior vena cava. Notably, the preoperative lumbar magnetic resonance imaging performed 5 years ago demonstrated that the herniated disc was located at the L4-L5 level, which corresponded to the location of IAVF. The patient successfully underwent endovascular closure by covered stent leading to the gradual resolution of symptoms and hemodynamic parameters. Although vascular complications from the LDS are very uncommon, most patients develop severe symptoms from worsening high-output heart failure. This case highlights the essence of careful

Abbreviations: IAVF, iliac arteriovenous fistula; LDS, lumbar discectomy surgery; CTA, computed tomographic angiography; RCIA, right common iliac artery; LCIV, left common iliac vein.

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history taking, physical examinations, and appropriate investigations in guiding the diagnosis and contemplating the treatment strategy.

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Introduction

Although normal or low cardiac output is usually found in the majority of patients with heart failure, a minority of them can present with a high-output state which has generally been referred to as high-output heart failure [1]. The pathophysiology is proposed to be related to decreased systemic vascular resistance [1]. The systemic arteriovenous shunts or fistulas, including congenital, traumatic, or hemodialysis fistula, are the common causes of high-output heart failure (22%) [1,2]. We described an uncommon case of high-output heart failure caused by an iliac arteriovenous fistula (IAVF), a rare but serious complication after lumbar discectomy surgery (LDS).

Case report

A 44-year-old man was evaluated for a 4-month history of progressive dyspnea, orthopnea, and leg edema. The patient had no prior contributory medical history except a history of symptomatic herniated nucleus pulposus necessitating the L4-L5 LDS 5 years ago. On examination, his blood pressure was 130/50 mmHg with a regular, bounding carotid pulse of 94 beats/min. His skin was warm with a normal capillary refill. There were distended internal jugular veins just below the mandible, a leftward and downward shift of cardiac apex. Neither cardiac murmur nor gallop was heard. There was a fine crackle at both basal lungs and mild bilateral pitting edema at both legs. A careful peripheral vascular examination revealed a systolic thrill with an audible bruit at the right groin. The other examinations were unremarkable.

Given the clinical characteristics of congestive heart failure accompanied by a wide pulse pressure, bounding carotid pulses, and warm skin, these were compatible with the high-output state. The abnormal systolic thrill and bruit at the right groin and the surgical history of L4-L5 LDS were suggestive of an iatrogenic arteriovenous fistula around this region, causing rapid circulatory time which finally led to the presentation of high-output heart failure. The differential diagnosis includes thyrotoxicosis, severe anemia, aortic regurgitation, or cardiac beriberi.

Chest radiography showed an increased cardiothoracic ratio of 0.6, a prominent pulmonary trunk, and mild pulmonary venous congestion of both lungs. Electrocardiography revealed a normal sinus rhythm with left ventricular hypertrophy by voltage criteria. Transthoracic echocardiography demonstrated mild biventricular dilatation with normal systolic function. Mild biatrial enlargement without significant valvular abnormality. The Doppler study showed pulmonary hypertension with the mean pulmonary artery pressure of 40 mmHg calculated with Abbas' formula. The high-output state was confirmed by the estimated stroke volume index of 84 mL/m^2 and cardiac index of 7.8 L/min/m^2. The relevant blood tests including complete blood count, thyroid function, and vitamin B1 study were normal.

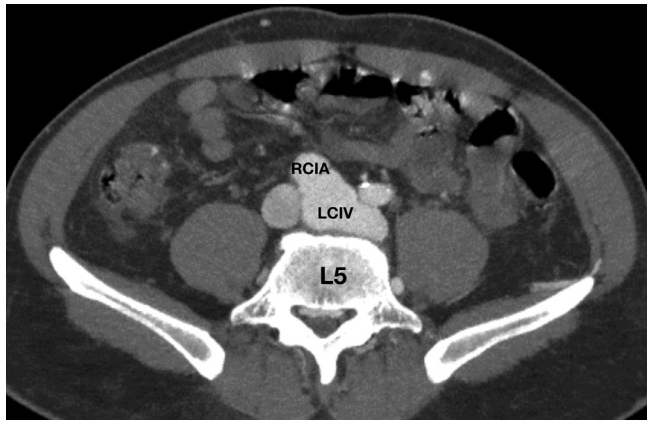

Fig. 1 – Computed tomographic angiography of the whole aorta. The fistula connects the right common iliac artery and the left common iliac vein in the axial view.

The patient underwent computed tomographic angiography (CTA) of the whole aorta to evaluate the location, extension, and anatomic relationship of the fistula. The axial view of CTA demonstrated the arteriovenous fistula connecting the right common iliac artery (RCIA) and the left common iliac vein (LCIV) at the L4-L5 level of vertebrae (Fig. 1). The sagittal view of CTA (Fig. 2A) showed the arteriovenous fistula (red arrow) from RCIA to LCIV at the L4-L5 level (yellow arrow). There was a significant shunting to the venous system causing marked dilatation of the inferior vena cava and venous system of the lower extremities (Fig. 2B, the 3D reconstruction of CTA in coronal view). Notably, the preoperative lumbar magnetic resonance imaging (Fig. 2C) performed 5 years ago demonstrated that the herniated disc located at the L4-L5 level (yellow arrow), which corresponded to the location of the fistula in Fig 2A.

After stabilization of the heart failure condition with the diuretic, according to the patient and heart team co-decision, an endovascular closure with a covered stent (Covera Plus 10 × 80 mm) at the RCIA to LCIV fistula was successfully performed via the right femoral artery. The final angiography showed a fully expanded stent with minimal peridevice leakage (Fig. 3). Dual antiplatelets with aspirin and clopidogrel were initiated and continued for 1 month, then a single antiplatelet with aspirin was planned for a life-long prescription. The patient had no immediate post-procedural complications. A diuretic was discontinued on the first week of follow-up. At

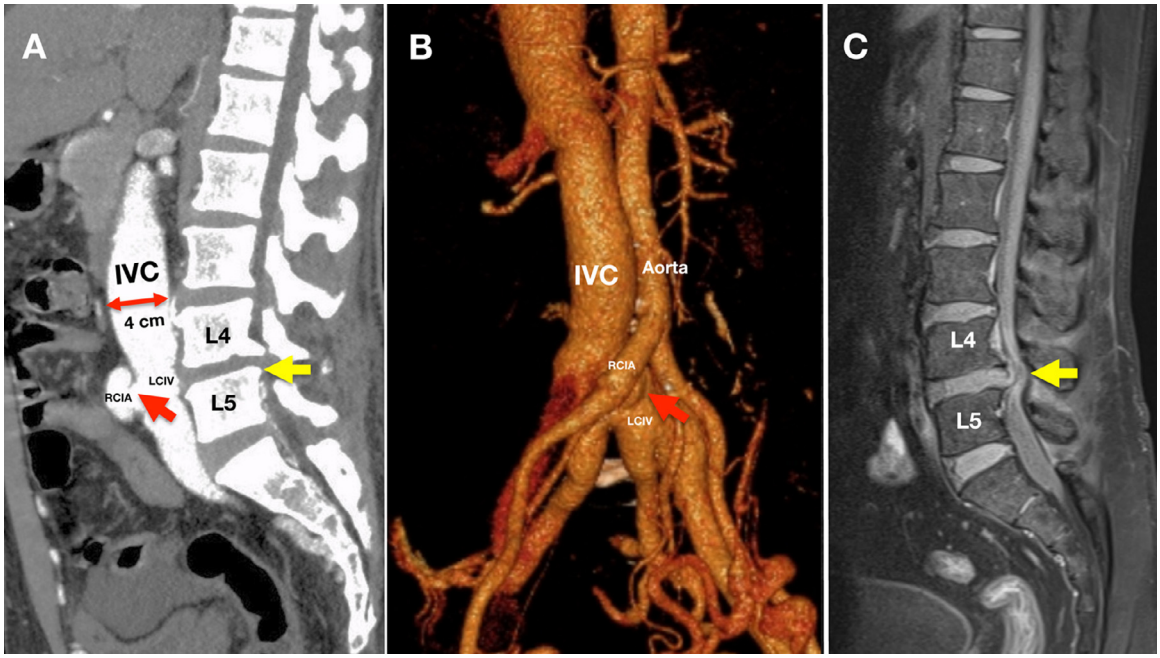

Fig. 2 – Computed tomographic angiography of the whole aorta and magnetic resonance imaging of the lumbar spine. (A) Computed tomographic angiography of the whole aorta in sagittal view shows the arteriovenous fistula (red arrow) from the right common iliac artery to left common iliac vein at L4-L5 level (yellow arrow). There was a significant shunting to the venous system causing the marked dilatation of the inferior vena cava. (B) 3D reconstruction in the coronal view shows the anatomic relationship of the fistula (red arrow). (C) The preoperative lumbar magnetic resonance imaging performed 5 years ago demonstrates the location of the herniated disc at the L4-L5 level (yellow arrow), which corresponds to the location of the fistula in panel (A).

Fig. 3 – Femoral angiography shows the successful placement of a long covered stent (arrows) at the right common iliac artery.

the subsequent visit, 6 weeks after the procedure, the patient was doing well and could perform daily activities without restriction. Also, a serial transthoracic echocardiography at the sixth week showed a significant improvement in pulmonary hypertension (mean pulmonary artery pressure = 23 mmHg) and high-output state (stroke volume index = 42 mL/m^2).

Discussion

The systemic arteriovenous shunts or fistulas, including congenital, traumatic, or hemodialysis fistula, are the common causes of high-output heart failure (22%) [1]. We described an

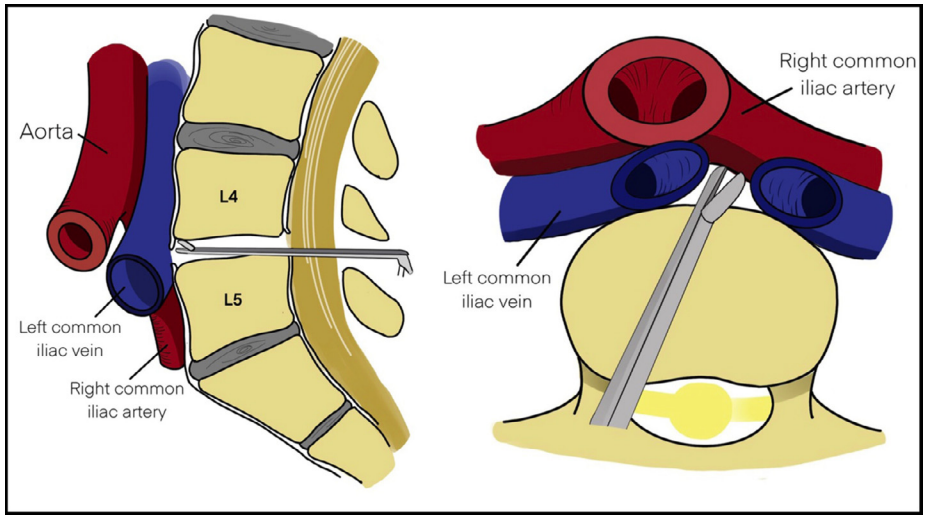

Fig. 4 – The proposed mechanism of iatrogenic injury resulting in the development of a fistula. The direct force from the sharp instrument may go through the anterior longitudinal ligament during the L4-L5 lumbar discectomy, causing the fistula between 2 vessels. (adapted from Roolvink, et al.) [8].

uncommon case of high-output heart failure caused by an IAVF, a rare but serious complication after LDS [2]. The time to diagnose an IAVF is varied, ranging from less than 24 hours to more than 30 years after the procedure. However, more than 70% of cases are recognized within 1 year [3,4]. The common manifestations of iatrogenic IAVF are abdominal bruit (60%), dyspnea (25%), tachycardia (23%), edema of the bilateral lower extremities (20%), and cardiac murmur (20%). A high-output heart failure is often developed month to a year after LDS (64%) [5]. The location of iatrogenic IAVF is hypothesized to be correlated with the intervertebral disc spaces where the surgery is performed, namely abdominal aorta to inferior vena cava fistula from the L3-L4 discectomy and RCIA to LCIV fistula from the L4-L5 or L5-S1 discectomy. The most common iatrogenic IAVF is the RCIA to right CIV (43%), followed by the RCIA to LCIV (15.9%), and the left CIA to LCIV (15.9%) [5]. The mechanism of injury is possibly due to the direct force from the sharp instrument that went through the anterior longitudinal ligament during the procedure, causing the fistula between 2 vessels (Fig. 4).

When IAVF is suspected, noninvasive imaging such as color duplex ultrasonography (first-line investigation), CTA, and magnetic resonance angiography, is the investigation of choice depending on center expertise. In most cases, the information from CTA or magnetic resonance angiography is needed to contemplate the therapeutic planning, including location, size, the anatomic relationship between the arterial site and venous site of a fistula as well as associated complications (eg, thrombus formation, pseudoaneurysm or dissection) [2,5].

Because of the advancement of endovascular instruments and techniques, the current management strategy of AVF has shifted from traditional open surgery to endovascular repair, which shows a comparable efficacy but has preferable safety, such as fewer complications and lower mortality [5–7]. However, anatomic suitability and center experience are crucial factors to be considered.

This case emphasizes the importance of careful history taking, especially the past surgical history, physical examination including palpation and auscultation around a suspicious area, and timely investigation with various imaging modalities in guiding the diagnosis and contemplating the treatment strategy for patients with high-output heart failure.

Conclusions

Although vascular complications from the LDS are very uncommon, most patients develop severe symptoms from worsening high-output heart failure. This case highlights the essence of careful history taking, physical examinations, and appropriate investigations in guiding the diagnosis and contemplating the treatment strategy.

Authors' contributions

PK, NT, and PC were responsible for the conception and design of the work as well as data analysis and interpretation. SS, AA, MT, CW, and SB were responsible for data collection. PK, SS, NT, AA, MT, CW, SB, and PC were responsible for the final approval of the version to be published.

Ethics approval

Ethics committee approval was waived.

Availability of data and materials

The data for this case report is located at King Chulalongkorn Memorial Hospital, Bangkok, Thailand.

Patient consent

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

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