

CASE REPORT

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Delayed open-heart operation to remove migrated intracardiac inferior vena cava stents in a living donor liver transplantation recipient: a case report

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ABSTRACT

Intracardiac migration of inferior vena cava (IVC) filter or stent is a rare but potentially fatal complication of endovascular venous device placement. There is no consensus whether migrated stents should be surgically removed by open cardiac surgery or retrieved by the percutaneous endovascular route and whether an intervention should be performed immediately or expectantly. Herein, we report a 39-year-old female who received emergent left lobe living donor liver transplantation (LDLT) owing to posthepatectomy liver failure. She underwent angioplasty for IVC stenosis 13 days after her LDLT during which time two IVC stents migrated into right atrium (RA). Because of acute kidney failure, she received perioperative continuous venous-venous hemofiltration. Owing to unstable hemodynamics and impaired liver graft function, an emergent open-heart operation or angiography to remove the migrated metallic stents in the RA was considered very high-risk. After recovery of liver graft and kidney function, she underwent an open-heart surgery to remove the intracardiac migrated IVC stents 40 days after the stent migration and recovered well. Our report is the first to show that a delayed open-heart operation for removal of migrated intracardiac IVC stents can be an acceptable choice in selected LDLT recipients.

Keywords: delayed open-heart operation, intracardiac migration of IVC stent, IVC stenosis, living donor liver transplantation

Abbreviations:

HV: hepatic vein

IVC: inferior vena cava

LDLT: living donor liver transplantation

RA: right atrium

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INTRODUCTION

Inferior vena cava (IVC) stent angioplasty is an intervention for IVC stenosis, which occurs in 1–2% of liver transplantation recipients.^{1,2} Intracardiac migration of IVC filter or stent is a rare but potentially fatal complication of endovascular venous device placement as it can cause right atrium (RA) rupture, aorto-right ventricular fistula, heart valve injury, thromboembolism, arrhythmia, and sudden death.^{3–7} Intracardiac migration of IVC stent has rarely been reported in liver transplantation recipients; however, any intracardiac migrated endovascular devices should be removed as soon as possible to prevent such catastrophic complications.^{5–9}

Herein, we reported a 39-year-old female who received emergent left lobe living donor liver transplantation (LDLT) owing to posthepatectomy liver failure. Thirteen days after LDLT, intraprocedural migration occurred of two IVC stents used for endovascular treatment of IVC and hepatic vein (HV) stenosis. Because of the operative risk, she received delayed surgical removal of the intracardiac migrated IVC stents by open-heart surgery 40 days after the stent migration. To our knowledge, such a case has not been reported, and we discuss the decision-making process for treatment of this patient.

CASE PRESENTATION

A female patient who was a hepatitis B virus carrier received extended right hepatectomy for her right hepatic lobe hepatocellular carcinoma and partial hepatectomy for recurrent tumor in the remnant liver in June 2016 and April 2017, respectively, when she was 39 years old. Unfortunately, 2 days after the second operation, she experienced posthepatectomy liver failure complicated by acute kidney failure. Continuous venous-venous hemofiltration was performed immediately. She had a model of end stage liver disease score of 40.

She received emergent LDLT with left lobe graft 5 days later after the diagnosis of posthepatectomy liver failure. The donor was her 42-year-old husband. The graft-to-recipient weight ratio was 0.82%. Reconstruction of the outflow tract was performed by end-to-side anastomosis of the common trunk of left and middle HV of the liver graft and recipient's IVC.

Her postoperative recovery was initially uneventful, and she was weaned from continuous venous-venous hemofiltration ten days after operation. However, stenosis over anastomosis of IVC and HV of the liver graft was diagnosed 13 days after her LDLT (Fig. 1A). Venography showed high-pressure gradients above and below the narrowing segment of IVC (9 mmHg) and between IVC and left HV (16 mmHg). To rescue the graft, we inserted a metallic stent (4.5 cm x 24 mm, Wallstent, Boston Scientific, Marlborough, MA) into the narrowed IVC. Unfortunately, proximal migration of the stent occurred, and another Wallstent (7 cm x 22 mm) was inserted immediately to stabilize the first stent. However, the second stent also migrated and both stents stayed at the junction of the RA and superior vena cava without further movement (Fig. 1B). Finally, another Wallstent (6 cm x 10 mm) was inserted from the IVC through the stenotic portion of anastomotic area to the left HV (Fig. 1B). The IVC pressure gradient decreased from 5 mmHg to 2 mmHg and left HV pressure decreased from 16 mmHg to 8 mmHg immediately after the left HV stent insertion. Therefore, partial relief of IVC stenosis was achieved and no further IVC treatment was given.

After the procedure, continuous venous-venous hemofiltration was resumed. Owing to the patient's unstable hemodynamics and impaired liver graft function, either emergent open-heart operation or angiography for removal of migrated metallic stents in the RA was considered a very high-risk operation. As our patient was without arrhythmia and valvular complication, we chose

expectant management and performed followed-up chest x-ray, electrocardiograms, and cardiac sonography. Antiplatelet (clopidogrel) and anticoagulation (heparin) agents were administrated to prevent stent-related thrombosis.

Forty days after the stent placement, the patient underwent an open-heart operation to remove the two migrated IVC stents in the RA (Fig. 2) during which time she had stable hemodynamics and recovered liver graft functions. This patient's renal function and lower extremities edema improved gradually due to partial relief of IVC stenosis after left HV stent insertion. She was successfully weaned from continuous venous-venous hemofiltration one week after operation. She was discharged three weeks after the operation and, at the 68-month follow-up, in good health condition.

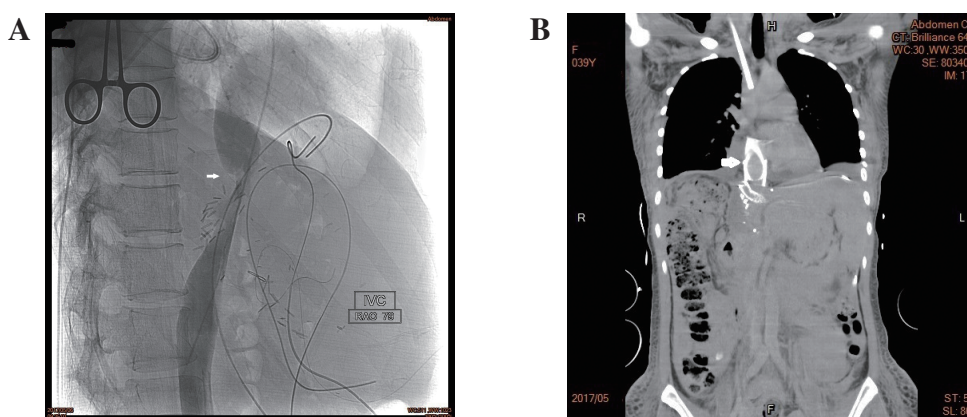


Fig. 1 Stenosis of outflow of liver graft and migrated intracardiac inferior vena cava stents

Fig. 1A: Stenosis at the anastomosis of inferior vena cava and hepatic vein of the liver graft (arrow) was diagnosed 13 days post-living donor liver transplantation.

Fig. 1B: Both stents stayed at their final position at the junction of the right atrium and superior vena cava (arrow).

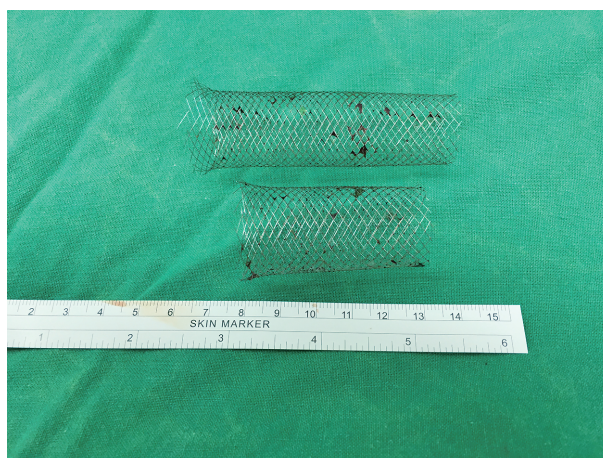


Fig. 2 The two migrated inferior vena cava Wallstents in the right atrium were removed 40 days after their migration.

This study was approved by Kaohsiung Medical University Hospital Institutional Review Board (Letter No. KMHIRB-E(II)-20200255).

DISCUSSION

Our experience with the patient demonstrated that delayed open-heart operation could be an acceptable treatment to remove migrated intracardiac IVC stents in selected recipients.

Post-liver transplantation IVC stenosis has a reported incidence of 1–3% and occurs mostly in the early period after surgery.^{1,2,10} Thus, intracardiac migration of IVC stents is a very rare complication in LT recipients. Three studies were reported before the case (Table 1).^{6,11,12} Two of them received open-heart surgery after a failed percutaneous intervention to remove the migrated IVC stents, and one received an emergent open-heart surgery (Table 1).

The etiologies of intracardiac migration of IVC stents include technical issues, miscalculation of IVC size, device failure, and patient's physical attributes.^{3,5,9} There is no consensus on patient management because each patient can have different presentations ranging from asymptomatic to sudden cardiogenic death.^{3,5,7} Both surgical and endovascular options exist. Generally, surgical removal of IVC stents or filters that migrated beyond the tricuspid valve are suggested owing to the possibility of circulation system collapse.^{4,6,8,9,13} As the techniques of percutaneous angioplasty have advanced, some authors suggest that surgical removal could be reserved after failing percutaneous endovascular route retrieval of migrated intracardiac stents, undertaken emergently or electively, especially if the patient was asymptomatic and had poor operative risks, and if

Table 1 Patients' characteristics and managements of migrated intracardiac inferior vena cava stents in four liver transplantation recipients

Source	Type of LT	Interval between stent placement and LT	Stent placement site/number of stents	Migration site	Complications of stent migration	Interval between stent migration and treatment	Management
Barrio-López et al, ⁶ 2012	Whole liver	14 months	Suprahepatic veins and the IVC/one	Protruding from the IVC into the roof of the RA	An aorta-to-right atrial fistula with rupture of the noncoronary sinus of Valsalva into the RA	1 day	Emergent open-heart surgery
Bobylev et al, ¹¹ 2015	Whole liver	N/A	IVC/one	Right ventricle	Fixed on the right trabecular ventricular wall	N/A	Open-heart surgery
Guimarães et al, ¹² 2005	Whole liver	5 months	IVC/one	RA	Aorta-to RA shunt ^a	3 years	Open-heart surgery following the second unsuccessful percutaneous retrieval of migrated stent
Current case	Left lobe DLT	13 days	IVC/two	RA	Asymptomatic	40 days	Open-heart surgery

IVC: inferior vena cava
DLT: living donor liver transplantation
LT: liver transplantation
RA: right atrium

^a This patient was asymptomatic with IVC stent left in RA for 3 years after unsuccessful initial attempt of percutaneous retrieval of it.

migrated IVC stents were in the RA.^{3,5,7,9,12}

The previous reports of endovascular retrieval of intracardiac migrated IVC stents or filters were of a single migrated device.^{5,7,12} The imaging studies of our patient showed the two migrated stents were in the RA and not beyond the tricuspid valve. Moreover, she had no symptoms of stent-related cardiac injury. Given that these two migrated IVC stents were overlapped and attached to the RA wall, we were concerned that an attempt at endovascular retrieval would cause damages to the RA and other catastrophic sequelae; furthermore, it would be a time-consuming procedure.^{12,13} The patient was at surgical risk for immediate open-heart surgery. Therefore, we decided wait until the recovery of her liver graft and renal functions and close observation of possible complications related to intracardiac stent or anticoagulation/antithrombotic drug before performing open-heart surgery.

No collateral development was found in this patient because her IVC stenosis was partially relieved by insertion of the left HV stent. The real hemodynamics of IVC pressure and RA pressure were followed up by using venography after the removal of stents. However, due to persistent improvement of her liver graft function and concern of contrast-related renal toxicity, we did not subsequently check the pressure gradient between IVC and RA.

CONCLUSIONS

A delayed open-heart operation to remove migrated intracardiac IVC stents located in the RA can be considered in an asymptomatic LDLT recipient with poor operation risks under close monitoring.

CONFLICT OF INTEREST DISCLOSURE

The authors state that they have no conflict of interest.

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