Simultaneous Live Donor Liver Transplantation, Aortic Valve Replacement, and Atrial Septal Defect Repair in a Patient With End Stage Liver Disease: A Case Report

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ABSTRACT

Valvular heart disease creates an important barrier for orthotopic liver transplantation in patients with end-stage liver disease and increases mortality. Selection of the appropriate surgical scheme and adequate postoperative management can be lifesaving in these cases. This study presents a 32-year-old man diagnosed with hepatitis C−associated cirrhosis and severe aortic regurgitation due to subacute bacterial endocarditis. Initially, simultaneous aortic valve replacement (AVR) and live donor liver transplantation (LDLT) was planned. However, intraoperative transesophageal echocardiography revealed an additional atrial septal defect (ASD) and AVR, ASD repair, and LDLT surgery were performed. During the 2-year follow-up period, there were no early or late complications. To the best of our knowledge, this is the first patient to have simultaneous AVR, ASD repair, and LDLT surgery. Additionally, the present case is also unique in being the first person in the Republic of Azerbaijan to undergo concomitant cardiac surgery and LDLT.

THE definitive treatment of end-stage liver disease (ESLD) is orthotopic liver transplantation (OLT). In these patients, cardiac diseases may accompany cirrhosis and require surgeries such as coronary artery bypass graft, valve replacement, or heart transplantation. Aortic valve disease may develop due to aortic stenosis or subacute bacterial endocarditis and poses a serious life-threatening risk to patients undergoing OLT. There are cases reported in the literature in which aortic valve replacement (AVR) and OLT have been applied concomitantly or subsequently [1,2]. The superiority of the aforementioned approaches over each other is still controversial, and there are no definite guidelines yet. This study presents the first case of simultaneous AVR, atrial septal defect (ASD) repair, and live donor liver transplantation (LDLT) in the Republic of Azerbaijan.

CASE PRESENTATION

A 32-year-old male patient diagnosed with cirrhosis due to hepatitis C was referred for consideration for LDLT. The patient complained of swollen feet, dyspnea, and fatigue on admission. He had a history of bilateral, intramuscular injection-related gluteal abscess and was diagnosed with aortic valve insufficiency due to infective endocarditis 3 months ago. Bilateral foot and ankle edema and ascites were detected on physical examination, but there were no signs of hepatic encephalopathy. Laboratory investigation revealed a hemoglobin level of 8.7 g/dL (range: 13.6-17.2), white blood cell count of $10 \times 10^3/\mu L$ (range: 4.3-10.3), platelet count of $62 \times 10^3/\mu L$ (range: 156-373), creatinine 0.7 mg/dL (range: 0.67-1.17), international normalized ratio (INR) level of 2.2, albumin 3 g/dL (range: 3.5-5.2), aspartate aminotransferase 235 U/L (cut-off: <50), alanine aminotransferase 211 U/L (cut-off: <50), and total bilirubin 4 mg/dL (range: 0.3-1.2). Hepatitis C RNA was negative after 3 months of combined sofosbuvir and daclatasvir therapy. Preoperatively obtained blood cultures were also negative. The

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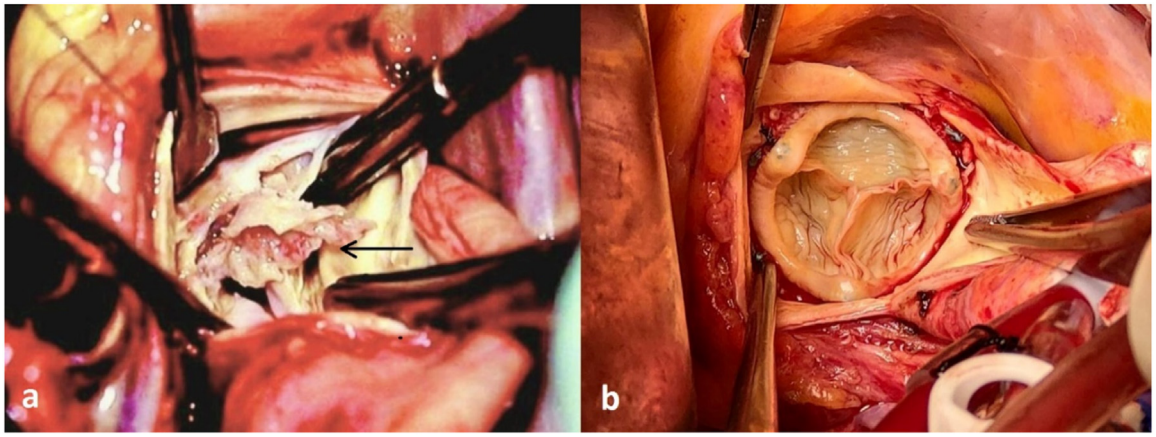

Fig 1. **(A)** Damaged aortic valve with vegetation due to subacute bacterial endocarditis. **(B)** View after bioprosthetic aortic valve replacement.

Child-Turcotte-Pugh score was 10 (Child C), and the model for end-stage liver disease score was 21. Transthoracic echocardiography showed concentric hypertrophy in the left ventricle (ejection fraction was 55%), vegetation on the noncoronary cusp of the aortic valve, and grade 2 to 3 aortic valve insufficiency.

A multidisciplinary surgery council evaluated the patient and decided to perform simultaneous AVR with a bioprosthetic valve and LDLT. The coagulopathy was not corrected before the surgery, nor was anticoagulant therapy employed. Intraoperative transesophageal echocardiography revealed grade 3 to 4 aortic regurgitation, 10 × 11 mm vegetation on the noncoronary cusp (Fig 1a), and 4.5 mm ASD. Initially, aortic root enlargement with the Nicks technique, bioprosthetic AVR (Labcor porcine bio prosthesis, 23 mm; Labcor Laboratórios, Ltd, Minas Gerais, Brazil), and primary ASD closure with 5/0 polypropylene suture were performed through a median sternotomy (Fig 1b). Aortic cross-clamp time and pump time lasted 91 and 126 minutes, respectively. Subsequently, the abdominal cavity was opened through an upper midline incision, 600 mL of ascites was drained, and native hepatectomy was carried out. Due to Yerdel grade 2 portal vein thrombosis in the recipient (80%-85% obstruction) (Fig 2), a thrombectomy of the portal vein was also performed [3]. After a right lobe weighing 926 grams was procured from the live donor, the graft was prepared on the back table, and after appropriate anastomoses, the LDLT was completed. The nonhepatic phase lasted 40 minutes, and the total estimated blood loss was 800 mL during both surgeries. The total duration of both procedures was 9 hours and 11 minutes. The patient was followed up in the intensive care unit for 2 days after the surgery, and no early postoperative complications were observed. Follow-up transesophageal echocardiography revealed a normal functioning bioprosthetic aortic valve. The postoperative immunosuppressive protocol consisted of methylprednisolone, tacrolimus, and mycophenolate mofetil was switched to everolimus on the postoperative 15th day because of severe diarrhea and kidney dysfunction. The patient was discharged on postoperative day 18, and outpatient follow-up continued without antiviral or anticoagulant therapy. Laboratory analysis in the postoperative 2nd month revealed a hemoglobin level of 9.8 g/dL, white blood cell count of $6 \times 10^3/\mu L$, platelets count of $142 \times 10^3/\mu L$, creatinine 0.9 mg/dL, INR level of 1.01, albumin 3.4 g/dL, aspartate aminotransferase 62 U/L, alanine aminotransferase 61 U/L, and total bilirubin 0.9 mg/dL. No complications were encountered for 2 years.

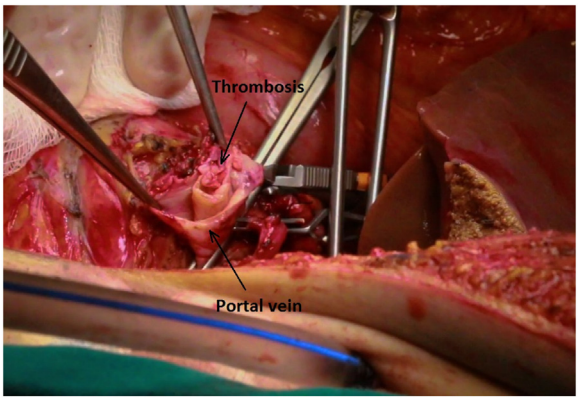

Fig 2. Grade 2 portal vein thrombosis in the recipient (80%-85% obstruction).

DISCUSSION

It has been shown that the risk of death after cardiac surgery in patients with Child B varies between 50% and 80% [4]. The planning of AVR and OLT is an important clinical decision. There are no definitive guidelines yet on the timing of the 2 operations. In patients undergoing OLT after AVR, severe coagulopathy due to ESLD, the need for anticoagulation after valve surgery, and reduced metabolism of general anesthetics in the cirrhotic liver might cause complications. On the other hand, performing OLT first may decompensate the existing valvular disease as it will create an extra burden on the heart. It should be noted that the heart of cirrhotic patients is vulnerable to stress due to peripheral vasodilation, low intravascular volume, and low contractility [5].

Table 1. Reports of Concomitant Aortic Valve Surgery and Liver Transplantation.

Author	Year	n	Cardiac Surgery	MELD Score or CTP	Complication*
Eckhoff et al	2001	1	CABG + AVR (bio†)	Child C	None
Parker et al	2001	1	AVR (bio†)	Not available	Grade IV
Nishida et al	2003	1	AVR (bio†)	29	Grade IV
Hanvesakul et al	2004	1	AVR (bio†)	Not available	Grade V
De Stephano et al	2010	4	3 AVR 1 CABG + AVR (3 bio†, 1 mec‡)	11-18-22-24	1 patient grade V
Sieders et al	2010	2	AVR (bio†)	29-35	1 intraoperative mortality
Lima et al	2011	7	3 CABG + AVR (bio†) 4 AVR (bio†)	11-13-24 12-18-18-19	1 patient grade V 1 patient grade V
Harrison et al	2014	1	AVR (bio†)	32	None
Tatum et al	2016	2	AVR (bio†)	38-40	1 patient grade II 1 patient grade IV
Cheung et al	2018	1	AVR (bio‡)	26	Grade III
Chaubey et al	2021	6	AVR	7-10-12-16-17-21	3 patients grade IV 1 patient grade V
Jacob et al	2022	4	2 AVR 2 CABG + AVR	18 (median)	Not available

* According to Clavien-Dindo Classification of postoperative complications.
† Bioprosthetic valve.
‡ Mechanical valve.AVR, aortic valve replacement; CABG, coronary artery bypass graft; CTP, Child-Turcotte-Pugh; MELD, model for end-stage liver disease.

Although the simultaneous approach is remarkably major surgery, it has the advantage of avoiding heart or liver failure following, regardless of the sequence of procedures. Concomitant AVR and OLT surgery was first applied in 2001 by both Parker et al and Eckhoff et al [6,7]. There are 31 cases of simultaneous AVR and OLT reported in the literature (Table 1) [2,4,6−14]. A systematic review reported that the median length of post-OLT hospital stay after staged cardiac procedures (8 days) was significantly shorter than concomitant (17 days) surgeries, with both groups having similar rates of in-hospital mortality [15]. On the contrary, in another study involving ESLD patients, in-hospital mortality was found to be significantly lower in patients who underwent concomitant cardiac surgery with OLT (25%) compared to staged surgery (71%) [4].

Recently, cases of OLT performed after bridging with transcatheter aortic valve implantation were reported [9]. Although it seems promising, performing this in experienced centers is essential, and studies with more patients are needed. In this context, it may be more appropriate to create a treatment plan after a multidisciplinary evaluation of the individual comorbid characteristics of the patient rather than a "one-size-fits-all" approach.

Considering the high INR and thrombocytopenia, no anticoagulant treatment was administered to the reported patient in the postoperative period. Although they have shorter lifetimes, a bioprosthetic valve was preferred because it does not necessitate anticoagulation. In addition, metallic valves were avoided because of the higher risk of bleeding and incidence of endocarditis.

CONCLUSIONS

Simultaneous open-heart surgery and LDLT provide the advantage of repairing valvular heart disease and ESLD. This is the first case presentation of a patient undergoing LDLT after AVR and ASD repair. Although this is a major procedure, it is safe and feasible to perform in select cases and should be in the armamentarium of transplant and cardiac surgeons.

DISCLOSURES

All the authors declare no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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