

ORIGINAL CONTRIBUTION

Successful Heart and Renal Allograft Transplantation From Patients With Child-Pugh Class C Cirrhosis

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ABSTRACT

Organ transplantation is a cornerstone of modern medicine and is often the sole lifesaving option for patients with end-stage organ disease. Despite its success, a global shortage of transplantable organs, compounded by a lack of donors, leads to many deaths among patients on waiting lists. Brain-dead patients with advanced cirrhosis are typically excluded as donors because of their critical condition. This report highlights the first documented heart transplantation and one of the few reported successful renal transplantations from donors with Child-Pugh class C cirrhosis and hepatorenal syndrome, challenging established donor eligibility criteria and expanding possibilities for addressing the organ shortage crisis.

DESPITE significant advances in transplantation medicine, the current organ supply system fails to meet the growing demand and must rely on altruistic donations from brain-dead or circulatory-dead patients [1]. Since 1984, an estimated 200,000 patients with end-stage organ failure have died while awaiting transplantation in the United States and European Union alone [2]. In the European Union, 10 to 11 patients die daily owing to an insufficient organ supply [3].

Globally, only 10% of the demand for organ transplants is met [4]. While donor shortage remains the primary challenge [5], inefficient use of available donors is exacerbating this crisis [6].

Patients with advanced liver disease are typically considered candidates for liver transplantation. Conversely, brain-dead patients with advanced cirrhosis, particularly Child-Pugh class C, are often excluded as organ donors because of their critical condition.

This work was reviewed and approved by the Ethics Committee of the University of Regensburg (25-4172-104).

CASE PRESENTATIONS

We present the cases of a 58-year-old female and a 45-year-old male with alcoholic Child-Pugh class C cirrhosis (Fig 1A).

Both patients were admitted to the gastroenterology department for liver transplant evaluation. Psychiatric evaluation

ruled out active addiction or other psychiatric conditions. The patients' high motivation and compliance led to positive psychiatric assessments for liver transplantation.

After completing all required evaluations and excluding contraindications, both patients were scheduled for placement on the liver transplant waiting list. However, during hospitalization, both developed spontaneous intracerebral hemorrhage (Fig 1B, arrow) and were promptly transferred to the intensive care unit. Endotracheal intubation was performed to prevent aspiration pneumonia. Blood tests showed worsening liver function and coagulopathy (Fig 2B-D and Fig 3B-D), which was treated with fresh frozen plasma infusions.

In both patients, a follow-up computed tomography (CT) scan revealed progression of the hemorrhage into the foramen magnum, signs of brain herniation, and displacement of the medulla oblongata (Fig 1C, arrow). Enlarged cerebrospinal fluid spaces suggested a circulation disorder (Fig 1D), prompting an emergency craniectomy, hematoma evacuation, and placement of an external ventricular drain (Fig 1E, arrow). Despite neurosurgical intervention and coagulation factor

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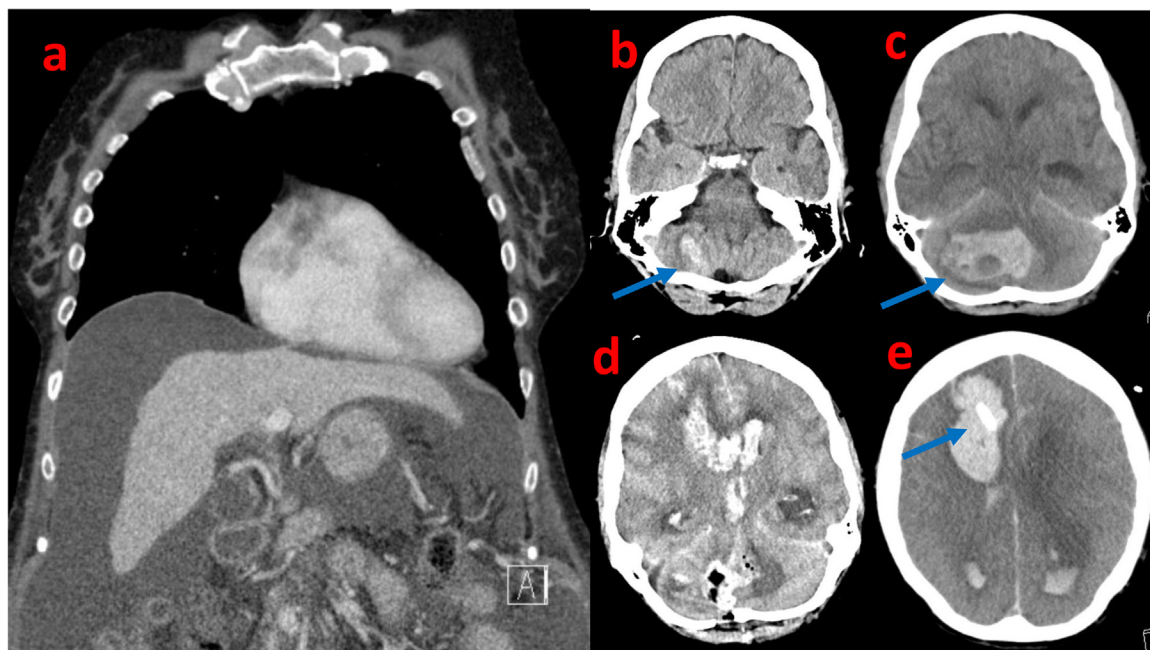


Fig 1. (A) Abdominal computed tomography (CT) scan showing advanced liver cirrhosis. (B) Cranial CT scan showing a right-sided cerebellar hemorrhage with perifocal edema. (C-E) Short-term follow-up CT scans revealing progression of the cerebellar hemorrhage (C) with new intraventricular and intraparenchymal cerebral hemorrhages (D and E).

replacement, the bleeding continued, and the patients' condition progressed to brainstem areflexia. In consultation with their relatives, the decision was made to evaluate the patients for potential organ donation.

With the family's consent, brain death was confirmed following German Medical Association guidelines through clinical examination and CT angiography. The 2 cases were then reported to Eurotransplant for organ allocation. The male patient could donate his

heart, while the female could donate 1 kidney despite hepatorenal syndrome with reduced urine output (30 mL/hour). The patients' main laboratory parameters are presented in Figures 2 and 3. To maintain diuresis, terlipressin and albumin were administered. Both organs were successfully transplanted in adult patients, with good post-transplantation function.

To our knowledge, this is the first documented successful heart transplantation and the second report of kidney donation

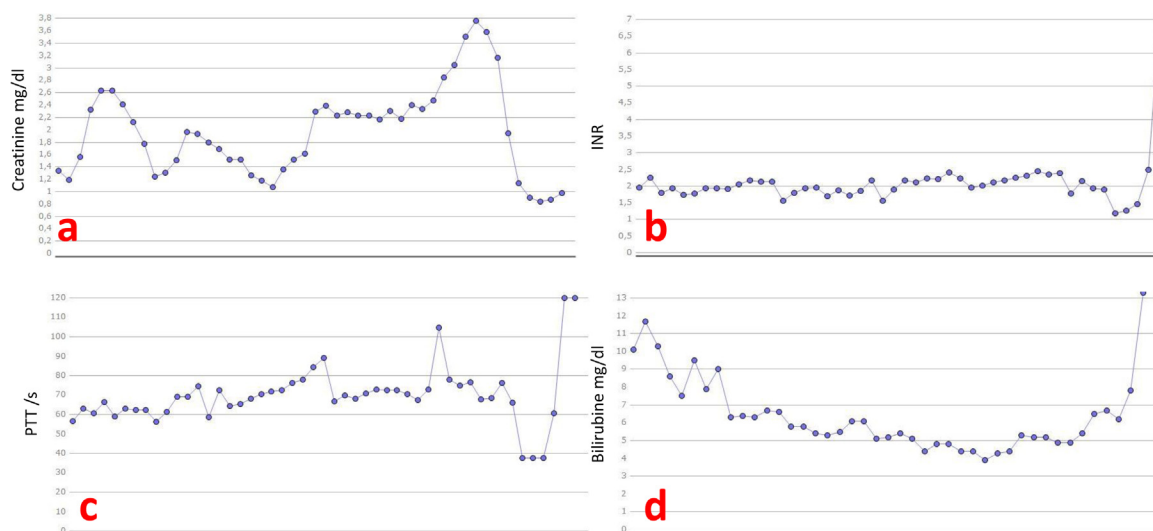


Fig 2. Creatinine (A), International Normalized Ratio (INR) (B), partial thromboplastin time (PTT) (C), and bilirubin (D) measurements the 3 months before brain death in the female patient.

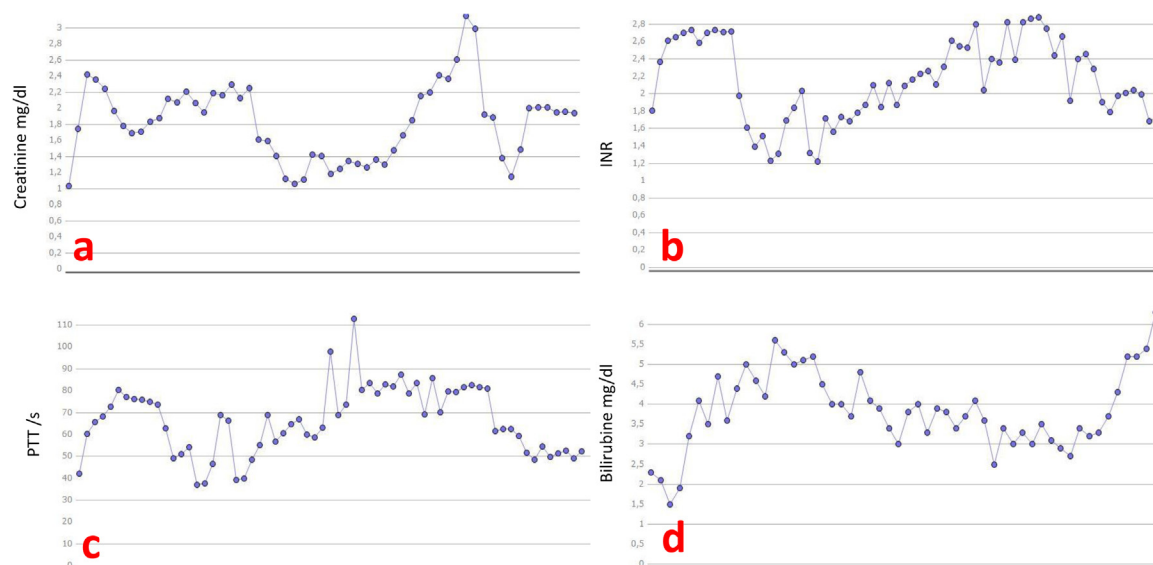


Fig 3. Creatinine (A), International Normalized Ratio (INR) (B), partial thromboplastin time (PTT) (C), and bilirubin (D) measurements the 3 months before brain death in the male patient.

from patients with Child-Pugh class C cirrhosis and hepatorenal syndrome.

DISCUSSION

The literature on donors with severe liver disease and hepatorenal syndrome is scanty, with only 1 report, from Koppel et al [7] in 1969. The authors reported that functional and long-term survival of cadaveric kidney transplants from patients with hepatorenal syndrome are similar to those achieved with cadaveric transplants from other sources. Furthermore, there is no report in the current literature on heart transplantations from donors with Child-Pugh class C cirrhosis.

As previous studies have suggested, many potentially transplantable organs are declined unnecessarily [8]. Expanding donor criteria could address the organ shortage crisis and reduce mortality among patients on waiting lists.

Given the large number of patients on waiting lists, every potential donor must be carefully evaluated. Patients with liver cirrhosis, particularly those with advanced Child-Pugh class C disease, are often overlooked as organ donors owing to their critical condition and extrahepatic organ dysfunction [9]. The actual report demonstrates that with thorough evaluation, patients in critical clinical conditions, such as those with Child-Pugh class C liver cirrhosis, can be organ donors. Although cirrhotic cardiomyopathy and hepatorenal syndrome are recognized as extrahepatic complications of liver cirrhosis [10], these 2 cases demonstrate that after careful evaluation, organs from Child-Pugh class C liver cirrhosis could be eligible for transplantation.

Along with the usual contraindications for organ donation in Germany [11], we took the following aspects into consideration in these 2 special cases. Increasing evidence acknowledges that marginal kidney donation offers better survival than dialysis

[12–15]. Moreover, hepatorenal syndrome is a potentially reversible condition [16,17]. Although her urine output was decreased, the female patient with hepatorenal syndrome still maintained acceptable diuresis, so we decided to continue the organ donation procedure. Further worsening of renal function with a decrease in urine output to <30 mL/hour including anuria despite pharmacologic stimulation would have been contraindications for organ donation, and other transplant centers probably would have rejected these organs had we attempted to place them in the allocation system.

Regarding the male patient who donated his heart, echocardiography revealed no significant pathologic myocardial modifications, with a normal ejection fraction (EF). Moreover, his electrocardiogram was normal. The current literature highlights that recipients of hearts with reduced EF have equivalent 1-year survival to recipients of hearts with normal EF [18]. Moreover, cirrhotic cardiomyopathy is potentially reversible [19]. Taking these considerations into account, we decided to proceed to organ procurement. On the other hand, a rapid deterioration of the EF to <40% or a new onset of relevant wall motion abnormalities would have represented contraindications in our case.

CONCLUSION

To the best of our knowledge, this is the first documented heart transplantation and one of the few reported cases worldwide of a successful renal allograft transplantation from donors with Child-Pugh class C cirrhosis and hepatorenal syndrome. These cases highlight the potential to expand donor eligibility criteria and address the organ shortage crisis.

DATA AVAILABILITY

Data will be made available on request.

DECLARATION OF COMPETING INTEREST

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

REFERENCES

- [1] Gunst J, Souter MJ. Management of the brain-dead donor in the intensive care unit. *Intensive Care Med* 2024;50(6):964–7.
- [2] Beard TR, Osterkamp R. The organ crisis: a disaster of our own making. *Eur J Health Econ* 2014;15(1):1–5.
- [3] Vanholder R, Dominguez-Gil B, Busic M, Cortez-Pinto H, Craig JC, Jager KJ, et al. Organ donation and transplantation: a multi-stakeholder call to action. *Nat Rev Nephrol* 2021;17(8):554–68.
- [4] The Lancet. Organ donation: lessons from the Spanish model. *Lancet* 2024;404(10459):1171.
- [5] Piperata A, Caraffa R, Bifulco O, Avesani M, Apostolo A, Gerosa G, et al. Marginal donors and organ shortness: concomitant surgical procedures during heart transplantation: a literature review. *J Cardiovasc Med (Hagerstown)* 2022;23(3):167–75.
- [6] Darpon J, Arrieta J, Elorrieta P, Olaizola P, Lavari R, Aranzabal J. Evaluation of a small organ procurement organization in the Basque country, Spain. *J Transpl Coord* 1996;6(4):167–70.
- [7] Koppel MH, Coburn JW, Mims MM, Goldstein H, Boyle JD, Rubini ME. Transplantation of cadaveric kidneys from patients with hepatorenal syndrome. Evidence for the functional nature of renal failure in advanced liver disease. *N Engl J Med* 1969;280(25):1367–71.
- [8] Wahba R, Suwelack B, Arns W, Cakiroglu F, Eisenberger U, Feldkamp T, et al. Rescue allocation and recipient oriented extended allocation in kidney transplantation-influence of the EUROTRANS-PLANT allocation system on recipient selection and graft survival for initially nonaccepted organs. *Transpl Int* 2017;30(12):1226–33.
- [9] Fernández J, Saliba F. Liver transplantation in patients with ACLF and multiple organ failure: Time for priority after initial stabilization. *J Hepatol* 2018;69(5):1004–6.
- [10] Jalan R, D'Amico G, Trebicka J, Moreau R, Angeli P, Arroyo V. New clinical and pathophysiological perspectives defining the trajectory of cirrhosis. *J Hepatol* 2021;75(Suppl 1):S14–26.
- [11] Englbrecht JS, Holling M. Organ donation after determination of brain death: Legal aspects and practical approach]. *Anaesthesiologie* 2023;72(1):67–78 [in German].
- [12] Bozkurt B, Kiliç M. Marginal donors in renal transplantation. *Transplant Proc* 2015;47(5):1273–81.
- [13] Borda B, Szederkényi E, Szenohradszky P, Kemény E, Marofka F, Keresztes C, et al. Functional and morphological changes in kidneys from marginal donors. *Transplant Proc* 2012;44(7):2139–42.
- [14] Hamano I, Hatakeyama S, Fujita T, Murakami R, Hamaya T, Togashi K, et al. Living kidney transplantation from marginal donors presents feasible donor renal function despite inferior recipient renal function. *Transplant Proc* 2020;52(6):1723–8.
- [15] Friedewald JJ. Utilization and outcomes of marginal kidneys –using Kidney Donor Risk Index to move beyond the current labels. *Am J Transplant* 2012;12(8):1971–2.
- [16] Muñoz LE, Alcalá EG, Cordero P, Martínez MA, Vázquez NY, Galindo S, et al. Reversal of hepatorenal syndrome in cirrhotic patients with terlipressin plus albumin. First experience in Mexico. *Ann Hepatol* 2009;8(3):207–11.
- [17] Lenz K, Buder R, Lohr G, Piringer P, Voglmayr M. Hepatorenal syndrome in decompensated cirrhosis: A special form of acute renal failure. *Med Klin Intensivmed Notfmed* 2016;111(5):440–6 [in German].
- [18] Chen CW, Sprys MH, Gaffey AC, Chung JJ, Margulies KB, Acker MA, et al. Low ejection fraction in donor hearts is not directly associated with increased recipient mortality. *J Heart Lung Transplant* 2017;36(6):611–5.
- [19] Liu H, Naser JA, Lin G, Lee SS. Cardiomyopathy in cirrhosis: From pathophysiology to clinical care. *JHEP Rep* 2023;6(1):100911.