DOI: 10.15825/1995-1191-2025-2-39-45

SUCCESSFUL LIVER TRANSPLANTATION IN A CRITICALLY UNDERWEIGHT PATIENT: A CASE REPORT

K.O. Semash[1], T.A. Dzhanbekov[1], R.A. Ibadov[2]

[1] National Children's Medical Center, Tashkent, Republic of Uzbekistan

[2] Republican Specialized Surgical Scientific and Practical Medical Center, Tashkent, Republic of Uzbekistan

Introduction. Living-donor liver transplantation (LT) is a viable and effective treatment option for patients with end-stage liver disease. Cachexia is widely recognized in medical literature as a risk factor affecting patient survival after LT. However, there are relatively few reports on LT in adult patients with critically low body weight. **Materials and methods.** The clinical case of successful LT in a critically underweight patient (BMI 12.9 kg/m^2) is presented. **Results.** The patient's pre-transplant preparation included intensified enteral and parenteral nutrition, albumin and fresh frozen plasma transfusions, diuretic therapy, multivitamins, symptomatic treatment, and structured exercise. At the time of transplantation, the recipient's MELD (Model for End-Stage Liver Disease) score was 22. In the postoperative period, the patient had multiple complications, reflected by a comprehensive complication index (Comprehensive Comprehensive) score of 99. Multicomponent rehabilitation was implemented. The patient was discharged 30 days after LT. During a 17-month follow-up, graft function remained satisfactory. **Conclusion.** Our experience, supported by literature data, indicates that cachexia in liver transplant recipients is associated with a higher overall complication rate after LT. Patients with low body weight require careful pre-transplant preparation, including intensive nutritional support and exercise programs. Successful treatment of such patients is feasible only in a multidisciplinary hospital or a transplant center with extensive expertise in managing complex cases.

Keywords: liver transplantation, related liver transplantation, underweight, cachexia, complications, rehabilitation.

INTRODUCTION

Living-donor liver transplantation (LT) is an effective treatment method for end-stage liver disease. Patients with liver cirrhosis are known to often develop metabolic complications [1]. Studies suggest that body mass index (BMI) can impact survival rates after LT [2–6]. At the same time, the majority of works on this topic are devoted to obese patients, and only a small part – to underweight and/or cachexic patients [7–9]. A low BMI (less than 18.5 kg/m^2) is generally associated with poorer surgical outcomes, and emaciated patients should be carefully prepared for upcoming surgical intervention [10]. LT is characterized by prolonged operative duration, significant surgical and anesthetic risks, and extensive surgical trauma, all of which significantly impact the course of the postoperative period in patients [11]. Below we present a clinical case of a successful LT in a critically underweight patient (with a body mass index of 12.9 kg/m^2): the peculiarities of the patient's pre-transplant preparation, as well as the peculiarities of the postoperative course and treatment of complications in this patient.

CLINICAL CASE

Patient H., 55 years old (Case No. 6729/2022), presented to our center on September 15, 2022, with complaints of jaundice, abdominal distension, lower extremity edema, severe weakness, and a 30-kg weight loss over the past year. He was unable to move independently or care for himself.

On initial examination, his height was 189 cm and weight 51 kg, corresponding to a BMI of 14.3 kg/m^2 (see Fig. 1). Diagnostic evaluation – including ultrasound, whole-body CT with intravenous contrast, and serologic testing – revealed decompensated liver cirrhosis, classified as Child–Pugh Class C with a MELD-Na score of 25. The cirrhosis was attributed to chronic hepatitis B and D coinfection in the active replication phase (HBV 8×10^8 copies/mL, HDV 3×10^7 copies/mL, confirmed by PCR). No signs of malignancy were detected.

The patient underwent a comprehensive work-up in accordance with the center's standard protocol [12, 13], which confirmed portal hypertension syndrome and associated complications, including ascites, splenomegaly, grade 2 esophageal varices, and thrombocytopenia (platelets 37×10^9/L).

Corresponding author: Konstantin Semash. Address: 10, Kichik Khalka Yuli str., Tashkent, 100096, Uzbekistan. Phone: +998 (94) 090-89-05. Email: mail@doctorsemash.com

Initial treatment involved antiviral therapy with tenofovir 25 mg daily for HBV. A stable virologic response was achieved after 35 days of therapy.

The patient was admitted to our center to prepare for LT. At the time of admission, the MELD-Na score was 26. In addition to ongoing antiviral therapy, pre-transplant management included transfusions of albumin and fresh frozen plasma (FFP), diuretics, ursodeoxycholic acid, gastroprotective therapy (esomeprazole and a combination of algeldrate with magnesium hydroxide), and vitamin supplementation.

Nutritional support consisted of a high-protein, high-carbohydrate diet, along with parenteral nutrition comprising amino acids, fats, carbohydrates, and electrolytes (total volume: 1920 mL/day), providing an estimated caloric intake of approximately 3,500 kcal/day. The patient also received supervised rehabilitation therapy, including therapeutic physical exercises.

As a result of comprehensive treatment, ascites resolved completely and lower limb edema subsided. However, due to fluid loss, the patient's weight decreased to 46 kg after one month (BMI 12.9 kg/m^2). Despite the weight loss, the patient reported increased energy, regained independent mobility, and was able to participate in physical therapy. At the time of transplantation, the MELD-Na score had improved to 22.

In parallel, following the standard protocol at our ward [12], the patient's 35-year-old son was evaluated as a living related donor of the right liver lobe. No absolute contraindications to liver donation were identified.

On November 23, 2022, the patient underwent a right lobe LT from his son. The graft weighed 900 grams, resulting in a graft-to-recipient weight ratio (GRWR) of 2.0%. Surgical technique details have been described in previous publications [13, 14].

Intraoperatively, hepatectomy was technically uneventful; however, blood loss occurred during inferior vena cava mobilization, necessitating intraoperative autologous blood reinfusion. Cold ischemia time was 93 minutes. The right lobe graft included an additional substantial inferior right hepatic vein (11 mm in diameter), requiring a second caval anastomosis. Warm ischemia time was 31 minutes.

Induction immunosuppression consisted of methylprednisolone 500 mg and basiliximab 20 mg. Arterial anastomosis was performed using interrupted sutures. The splenic artery was ligated to modulate portal blood flow and prevent steal syndrome [14, 15].

Biliary reconstruction presented technical challenges due to the patient's anthropometric features. Although the graft had a single bile duct, its deep location in the right subdiaphragmatic space precluded biliary-biliary anastomosis. Additionally, the short jejunal mesentery created tension during construction of the biliodigestive anastomosis. Nonetheless, stent placement and bile duct drainage were successfully completed.

The total operation time was 570 minutes, with an estimated blood loss of 1300 mL. Intraoperative Doppler sonography confirmed satisfactory vascular anastomoses with no abnormalities detected.

Fig. 1. Patient's appearance: a, on first examination: BMI was 14.3 kg/m^2; b, on day 17 after liver transplantation: BMI was 12.9 kg/m^2; c, 10 months after transplantation: BMI was 21.8 kg/m^2

The recipient was initially managed in the intensive care unit (ICU), where extubation was performed uneventfully 12 hours after surgery. The standard immunosuppressive regimen included low-dose methylprednisolone and tacrolimus. On postoperative day 3, the patient developed febrile fever (up to 39 °C). In response, the antibacterial therapy was adjusted, and immunosuppressive treatment was temporarily discontinued. Ultrasound on postoperative day 4 revealed fluid accumulation in the right subdiaphragmatic region; diagnostic puncture confirmed the presence of bile, indicating a biloma.

Despite percutaneous drainage, adequate cavity sanitation could not be achieved. The patient continued to experience febrile episodes, and inflammatory markers rose sharply (C-reactive protein: 152 mg/L; procalcitonin: 20 ng/mL). This clinical deterioration necessitated relaparotomy with abdominal cavity sanitation and redrainage on postoperative day 6.

Following surgery, the patient demonstrated clinical improvement, marked by a decline in inflammatory markers. He was transferred from the ICU to the surgical ward on postoperative day 9 (day 3 after relaparotomy).

On postoperative day 10, in the evening, the patient vomited the food he had eaten and and subsequently aspirated during sleep, leading to a sharp drop in oxygen saturation to 30%. No circulatory arrest occurred. The patient was urgently transferred to the ICU, where he was intubated and placed on mechanical ventilation.

Emergency fibrobronchoscopy revealed and cleared a substantial amount of aspirated food material (porridge) from both lungs. Due to the severity of the aspiration event, the patient required prolonged ventilatory support. Daily sanitation fibrobronchoscopies were performed twice daily.

He received comprehensive care, including broad-spectrum antibacterial and antiviral therapy, gastroprotective agents, albumin and FFP transfusions, inhalation therapy, and symptomatic treatment. In light of ongoing aspiration pneumonia, persistent subfebrile and febrile episodes, and elevated inflammatory markers, immunosuppressive therapy was withheld. Despite the complications, liver graft function remained stable throughout, as shown in Fig. 2.

The patient also developed recurrent bilateral pleurisy, necessitating repeated thoracenteses and eventual pleural drainage. Given his severe malnutrition and cachexia, a naso-intestinal feeding tube was placed endoscopically. Nutritional support included both enteral feeding and parenteral nutrition with amino acid, fat, carbohydrate, and electrolyte solutions.

Importantly, the patient was not sedated during the extended period of ventilation. He was maintained in a sitting position and engaged in twice-daily physical therapy sessions under the supervision of a physiotherapist.

Against the background of comprehensive therapy, the patient showed positive clinical progress. The septic condition resolved, and extubation was successfully per-

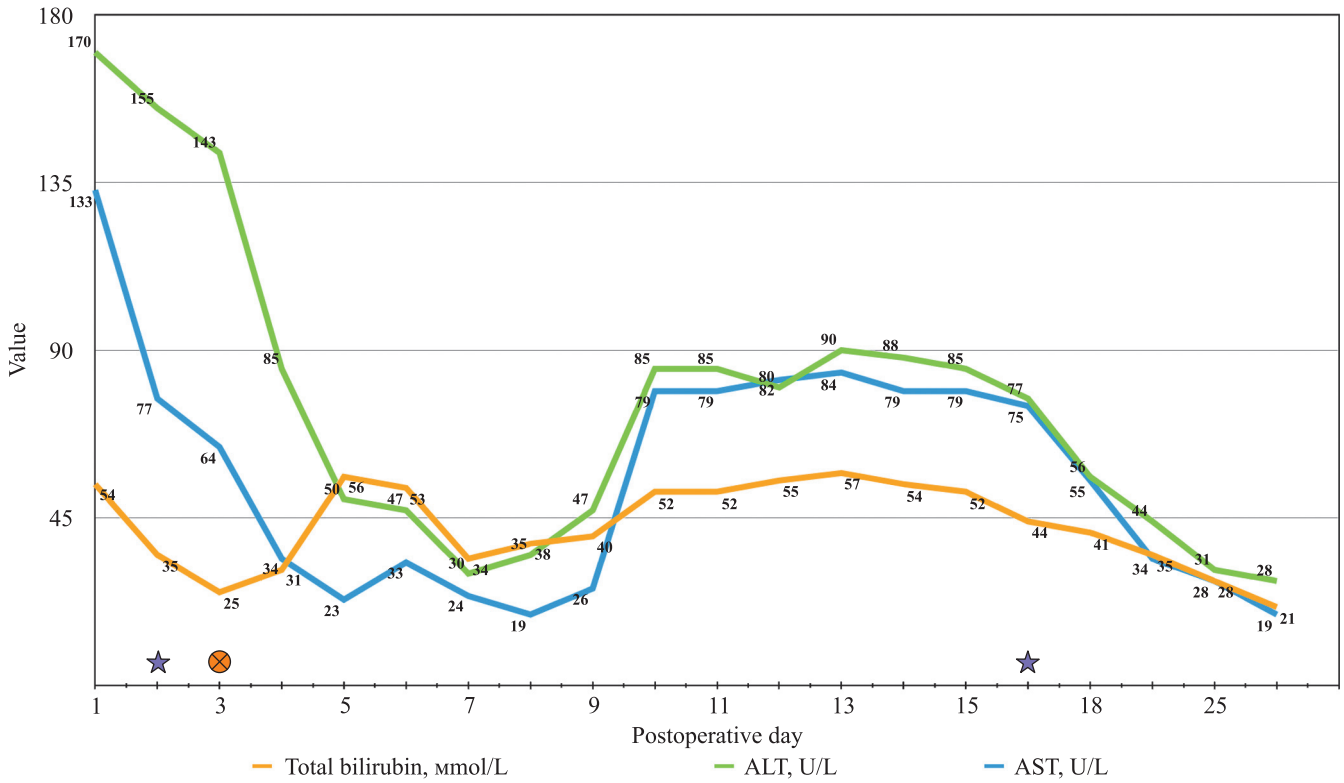

Fig. 2. Laboratory dynamics of liver graft function. Asterisk indicates days when tacrolimus was administered. Cross indicates the days when immunosuppressive therapy was completely discontinued

Table

Complications in the patient

Complication	Clavien–Dindo grade
Need for parenteral nutrition	2
Biloma (puncture)	3a
Right-sided pleurisy, puncture	3a
Left-sided pleurisy, puncture	3a
Right-sided pleurisy, drainage (×2)	3a
Left-sided pleurisy, drainage	3a
Malnutrition, insertion of nasointestinal tube	3a
Aspiration pneumonia, need for daily bronchoscopies (×11)	3a
Peritonitis (relaparotomy)	3b
Aspiration	4a
Sepsis	4a
Calculation of Comprehensive Complication Index (CCI) score	99

formed on postoperative day 17 (day 7 after aspiration). The patient was subsequently transferred to the surgical ward for continued care.

Immunosuppression was maintained with tacrolimus monotherapy, targeting serum levels of 6–9 ng/mL. In addition to ongoing medical management, the patient received daily massage therapy and continued rehabilitation with physiotherapists. Liver graft function fully normalized.

The enteral feeding tube was removed on postoperative day 24, coinciding with the discontinuation of parenteral nutrition. The patient was successfully transitioned to full oral nutrition.

Spontaneous resolution of bile leakage occurred by postoperative day 26, and the safety drain from the bile leak site, placed earlier, had already been removed on postoperative day 2. A summary of the patient's complications is presented in Table.

The patient was discharged in satisfactory condition on postoperative day 30, with stable graft function. He continues to be followed on an outpatient basis and remains alive 17 months post-transplant, with consistently stable liver graft function. His weight increased to 78 kg, corresponding to a BMI of 21.8 kg/m^2 (Fig. 1).

DISCUSSION

Sarcopenia is a well-documented complication of cirrhosis [1, 3]. Nevertheless, according to literature review, there are significantly more overweight patients (BMI >30 kg/m^2) who are LT candidates than critically underweight patients [2]. In addition, most studies have focused on managing obese liver recipients [4–6]. For example, according to an analysis of the UNOS database over a 22-year period, among 73,538 adult liver transplant recipients, less than 1% of patients had a BMI of less than 18.5 kg/m^2 [7]. Meanwhile, the impact of cachexia on the survival of LT recipients has been extensively studied. Underweight status in LT recipients has been identified as an independent risk factor that significantly impairs post-transplant survival. Analyses conducted across different decades consistently show that low BMI is a significant predictor of reduced survival. Specifically, the three-year survival rate for patients with a BMI below 18.5 kg/m^2 was 68%.

Also, according to other studies, an interesting correlation was obtained when low BMI in recipients was adjusted for MELD [8, 9]. Patients with low body weight and a MELD score of either <20 or >26 had increased mortality rates. However, the authors failed to show any significant relationships between other patient factors (e.g., comorbidities), donor factors (graft quality) and post-transplant mortality in patients with low BMI and MELD score.

Notably, liver recipients with critically low body weight face a markedly increased risk of infectious complications. Compared to individuals with normal or slightly elevated BMI, those with a BMI under 16 kg/m^2 had a tenfold higher risk of developing severe infections, including pneumonia, abscesses, intra-abdominal infections, and sepsis [4]. Interestingly, despite this heightened vulnerability to systemic infections, cachectic patients were found to have a lower incidence of wound infections than their normal or overweight counterparts.

Our clinical case reinforces the above findings. A critically underweight patient with decompensated cirrhosis (Child–Pugh class C) required specific preparation for LT. In addition to antiviral therapy and management of cirrhosis-related complications, particular emphasis was placed on comprehensive nutritional support [10, 16]. Malnutrition in patients with cirrhosis is a known factor associated with poorer survival outcomes – not only compared to individuals with normal weight but also to those with obesity. A large cohort study investigated whether optimizing nutritional status prior to LT could improve outcomes. The authors demonstrated that each unit increase in BMI resulted in a 2% decrease in mortality rate [16]. However, this study did not account for the patient's dry weight in the calculations. In our case, des-

pite comprehensive therapy for cirrhosis complications and adequate nutritional support through enteral and parenteral methods, the patient's body weight decreased due to removal of excess fluid, ultimately achieving the patient's dry weight. Nevertheless, this reduction was accompanied by an improvement in the patient's overall condition, allowing for independent movement, partial self-care, and engagement in physical exercises.

Postoperative complications were assessed using the Clavien–Dindo classification. However, this system does not account for the cumulative burden of multiple complications in a single patient. Therefore, we also utilized the Comprehensive Complication Index (CCI), which offers a more nuanced evaluation by integrating all postoperative complications into a single score. In this case, the patient's CCI was 99 – approaching the maximum score of 100, which corresponds to patient death – indicating the extreme severity of the postoperative course [17].

Regarding the postoperative complications observed in our recipient, we believe cachexia was a significant contributing factor. The development of bile leakage was primarily influenced by the patient's anthropometric characteristics, which created technical challenges in the formation of the biliodigestive anastomosis. Biliary stenting subsequently necessitated percutaneous drainage of the resulting biloma and ultimately led to relaparotomy. Aspiration pneumonia, followed by sepsis, further complicated the clinical course.

Cachexia is known to be an independent risk factor for aspiration and aspiration-related complications [18]. In this case, daily tracheobronchial drainage and comprehensive antibacterial therapy facilitated resolution of the pneumonia and a return to spontaneous breathing.

Despite intensified nutritional support and albumin supplementation, ongoing protein-energy malnutrition, combined with multiple infectious complications, resulted in the development of bilateral pleural effusions, which required thoracentesis and subsequent pleural drainage.

A key component of successful rehabilitation in such patients, in addition to nutritional support, is early and sustained physical activation [10]. Notably, the patient was not sedated even during prolonged mechanical ventilation and engaged in passive and active physical exercises in lying and sitting positions. Physical therapists and massage specialists were actively involved in the rehabilitation process. It was only through this comprehensive, multidisciplinary approach that we were able to save the patient and discharge him in satisfactory condition.

CONCLUSION

Our experience, supported by literature data, indicates that cachexia in liver transplant recipients is associated with a higher overall complication rate after LT. Patients with low body weight require careful pre-transplant preparation, including intensive nutritional support and exercise programs. Successful treatment of such patients is feasible only in a multidisciplinary hospital or a transplant center with extensive expertise in managing complex cases.

The authors declare no conflict of interest.

REFERENCES

1. *Salimov UR, Stoma IO, Fedoruk DA, Kovalev AA, Scherba AE, Rummo OO*. Sarcopenia in chronic liver disease, can we predict complications? *Transplantologiya. The Russian Journal of Transplantation*. 2022; 14 (4): 408–420. https://doi.org/10.23873/2074-0506-2022-14-4-408-420.
2. *Pelletier SJ, Schaubel DE, Wei G, Englesbe MJ, Punch JD, Wolfe RA et al*. Effect of body mass index on the survival benefit of liver transplantation. *Liver Transpl*. 2007; 13 (12): 1678–1683. https://doi.org/10.1002/lt.21183.
3. *Salimov U, Kovalev A, Stoma I, Fedoruk A, Rummo O*. Evaluation of Factors Affecting Long-Term Survival after Liver Transplantation. *Surgery. Eastern Europe*. 2023; 12 (3): 238–247. https://doi.org/10.34883/PI.2023.12.3.016.
4. *Diaz-Nieto R, Lykoudis PM, Davidson BR.* Recipient body mass index and infectious complications following liver transplantation. *HPB (Oxford)*. 2019 Aug; 21 (8): 1032–1038. https://doi.org/10.1016/j.hpb.2019.01.002.
5. *Van Son J, Stam SP, Gomes-Neto AW, Osté MCJ, Blokzijl H, van den Berg AP et al.* Post-transplant obesity impacts long-term survival after liver transplantation. *Metabolism*. 2020 May; 106: 154204. https://doi.org/10.1016/j.metabol.2020.154204.
6. *García-Fernández N, Cepeda-Franco C, Beltrán-Miranda P, García-Muñoz P, Álamo-Martínez JM, Padillo-Ruiz FJ, Gómez-Bravo MÁ*. Body Mass Index as a Prognostic Factor in Liver Transplantation. *Transplant Proc*. 2020 Jun; 52 (5): 1493–1495. https://doi.org/10.1016/j.transproceed.2020.03.008.
7. *Dick AA, Spitzer AL, Seifert CF, Deckert A, Carithers RL Jr, Reyes JD, Perkins JD*. Liver transplantation at the extremes of the body mass index. *Liver Transpl*. 2009 Aug; 15 (8): 968–977. https://doi.org/10.1002/lt.21785.
8. *Bambha KM, Dodge JL, Gralla J, Sprague D, Biggins SW.* Low, rather than high, body mass index confers increased risk for post-liver transplant death and graft loss: Risk modulated by model for end-stage liver disease. *Liver Transpl*. 2015 Oct; 21 (10): 1286–1294. https://doi.org/10.1002/lt.24188.
9. *Bari K, Sharma P.* Impact of body mass index on post-transplant outcomes reexamined. *Liver Transpl*. 2015 Oct; 21 (10): 1238–1240. https://doi.org/10.1002/lt.24227.
10. *Joliat GR, Kobayashi K, Hasegawa K, Thomson JE, Padbury R, Scott M et al.* Guidelines for Perioperative Care for Liver Surgery: Enhanced Recovery After Surgery (ERAS) Society Recommendations 2022. *World J*

Surg. 2023 Jan; 47 (1): 11–34. https://doi.org/10.1007/s00268-022-06732-5.

11. *Lee DD, Li J, Wang G, Croome KP, Burns JM, Perry DK, Nguyen JH et al.* Looking inward: The impact of operative time on graft survival after liver transplantation. *Surgery*. 2017 Oct; 162 (4): 937–949. https://doi.org/10.1016/j.surg.2017.05.010.
12. *Semash K, Janbekov T, Akbarov M, Usmonov A, Gaibullaev T*. Stages of preparation and examination of related liver donors and their perioperative management. *Coloproc*. 2023; 15 (1): 41–54. https://doi.org/10.56121/2181-4260-2023-1-41-54.
13. *Semash K, Dzhanbekov T, Akbarov M, Mirolimov M, Usmonov A, Razzokov N et al.* Implementation of Living Donor Liver Transplantation Program in the Republic of Uzbekistan – Report of First 40 cases. *Clin Transplant Res*. 2024 Jun 30; 38 (2): 116–127. https://doi.org/10.4285/ctr.24.0013.
14. *Semash KO, Dzhanbekov TA, Gaybullaev TZ*. Single center experience of intraoperative ligation of the splenic artery for prevention of splenic artery steal syndrome in patients after living donor liver transplant. *Transplantologiya. The Russian Journal of Transplantation.* 2024; 16 (2): 230–243. https://doi.org/10.23873/2074-0506-2024-16-2-230-243.
15. *Semash KO, Dzhanbekov TA, Akbarov MM*. Vascular complications after liver transplantation: contemporary approaches to detection and treatment. A literature review. *Russian Journal of Transplantology and Artificial Organs*. 2023; 25 (4): 46–72. (In Russ.). http://doi.org/10.15825/1995-1191-2023-4-46-72.
16. *Orci LA, Majno PE, Berney T, Morel P, Mentha G, Toso C*. The impact of wait list body mass index changes on the outcome after liver transplantation. *Transpl Int*. 2013 Feb; 26 (2): 170–176. https://doi.org/10.1111/tri.12017.
17. *Lai Q, Melandro F, Nowak G, Nicolini D, Iesari S, Fasolo E et al.* The role of the comprehensive complication index for the prediction of survival after liver transplantation. *Updates Surg*. 2021 Feb; 73 (1): 209–221. https://doi.org/10.1007/s13304-020-00878-4.
18. *Niederman MS, Cilloniz C*. Aspiration pneumonia. *Rev Esp Quimioter*. 2022 Apr; 35 Suppl 1 (Suppl 1): 73–77. https://doi.org/10.37201/req/s01.17.2022.

The article was submitted to the journal on 25.06.2024