Changes in Muscle Strength and Six-Minute Walk Distance Before and After Living Donor Liver Transplantation

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ABSTRACT

Background. Impaired exercise capacity and muscle weakness are important characteristics of liver transplantation recipients. Perioperative rehabilitation has been introduced to promote early mobilization of patients and to prevent postoperative pulmonary complications. However, it is unknown how physical status recovers during the hospital stay after a liver transplant. The purpose of this study was to evaluate the changes in clinical indicators that represent the functional exercise capacity and muscle strength before and after living donor liver transplantation (LDLT).

Methods. We retrospectively reviewed 21 consecutive patients who underwent LDLT with perioperative rehabilitation from April 2014 to December 2015. Twelve patients who were tested for 6-minute walk distance, hand-grip strength, and isometric knee extensor muscle strength before and 4 weeks after LDLT were enrolled.

Results. At the preoperative baseline, the 6-minute walk distance significantly correlated with the Model for End-stage Liver Disease score and pulmonary functions (vital capacity, forced vital capacity, and forced expiratory volume in 1 second of predictive values). Comparisons between the preoperative and postoperative values revealed significant decreases in weight, Barthel Index, hand-grip strength, and isometric knee extensor muscle strength. Changes in hand-grip strength and isometric knee extensor muscle strength after LDLT correlated with the preoperative Model for End-stage Liver Disease score.

Conclusions. Physical functional status had not been fully recovered 4 weeks after LDLT. Further investigation regarding developing a strategy for prevention of muscle atrophy before LDLT and recovery of physical fitness after LDLT would be helpful.

IN JAPAN, the number of recipients who undergo living donor liver transplantation (LDLT) is greater than the number undergoing deceased donor liver transplantation (DDLT) due to low donation rates for deceased donors [1]. Although LDLT offers the potential advantage of a shorter waiting time, candidates for LDLT with end-stage liver disease experience a significant decline in physical performance similar to those on the waiting list for DDLT [2,3]. Systemic manifestations of severe liver failure such as sarcopenia, malnutrition, depression, impaired aerobic capacity, and deconditioning lead to motor deficiency and decreased exercise capacity [4,5]. Perioperative physical rehabilitation has therefore been emphasized to enhance recovery of physical fitness after liver transplantation [6].

The 6-minute walk test (6MWT) is a simple and practical test that evaluates exercise capacity specifically in patients with respiratory diseases, including lung transplantation recipients [7,8]. The 6-minute walk distance (6MWD) assessed by using the 6MWT also determines functional capacity and predicts mortality of liver transplant candidates

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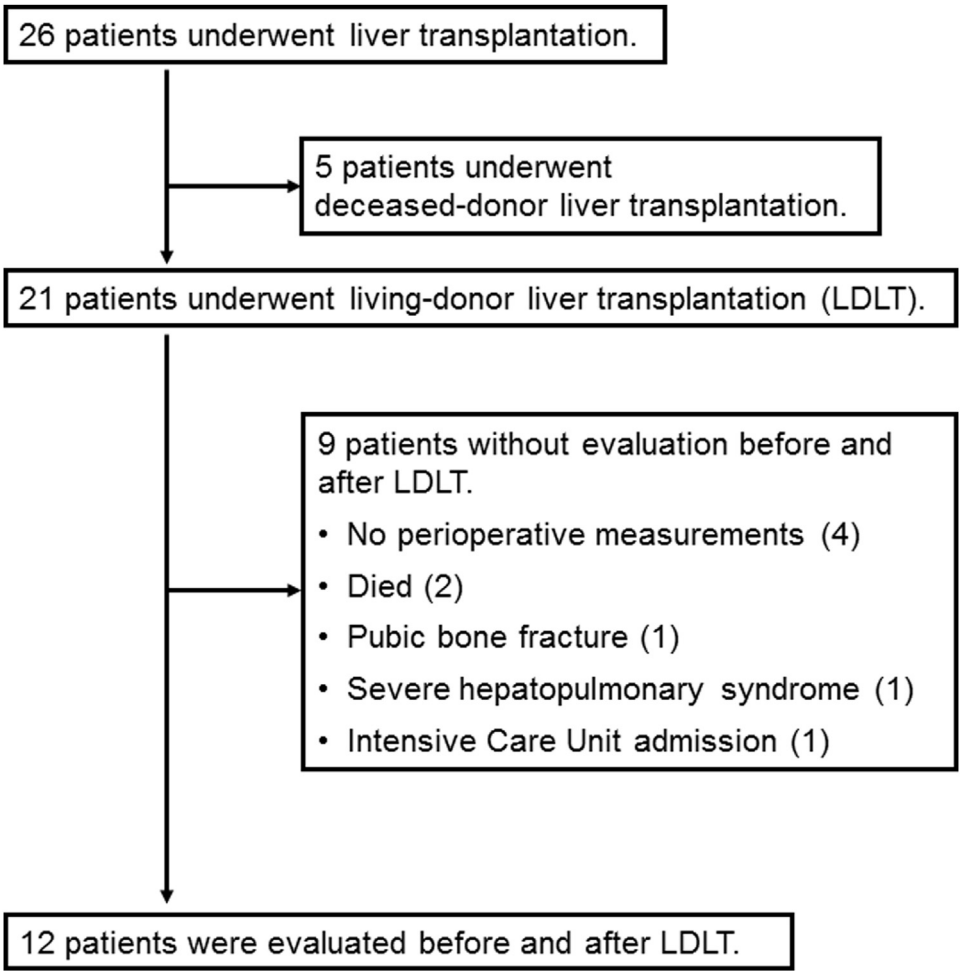

Fig 1. Classification of participants.

[9–11]. Moreover, it has been suggested that the 6MWD could be used to estimate aerobic capacity and assist in planning of a rehabilitation program after liver transplantation [10,12]. It reportedly takes several months for physical fitness, including muscle strength, 6MWD, and maximal oxygen uptake, to improve after a liver transplant [10,13,14], but the changes in physical fitness have not been fully evaluated in patients who have undergone LDLT.

The purpose of the present study was to evaluate 6MWD and muscle strength recovery during hospital stays shortly after LDLT with perioperative rehabilitation. We characterized the preoperative and postoperative physical statuses and related them to clinical data in LDLT recipients with end-stage liver diseases.

PATIENTS AND METHODS

Patients

Medical records of liver transplantation patients (aged ≥15 years) at the Department of Transplantation Surgery, Nagoya University Hospital, from April 2014 to December 2015 were retrospectively reviewed. During this period, 21 patients underwent LDLT, and 5 underwent DDLT. At our institution, recipients routinely undergo perioperative rehabilitation. Especially for patients scheduled for LDLT, preoperative rehabilitation could be indicated when patients' conditions were applicable. Among the 21 LDLT recipients, 12 patients who participated in the perioperative rehabilitation program and whose preoperative as well as postoperative physical performance had been assessed successfully were enrolled in this study. A flowchart illustrating the inclusion process is shown in Fig 1. Severity of liver disease was evaluated by using the Child-Pugh score and the Model for End-stage Liver Disease (MELD) score. Postoperative complications were graded according to the Clavien-Dindo classification [15].

This study was approved by the local ethics committee of Nagoya University Hospital (no. 2015–0413). Because no patient identifiers were included, the informed consent requirement to participate and publish was waived for this retrospective analysis. However, the study information was disclosed to the target patients via the Internet at Nagoya University Hospital to allow the candidate patients to refuse to participate.