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BRIEF COMMUNICATION

Simultaneous Liver Transplantation and Sleeve Gastrectomy: Prohibitive Combination or a Necessity?

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Abstract Previously, many morbidly obese (MO) patients were denied liver transplantation (LT) because of the higher operative risk. However, nowadays, 5 and 10 years graft survival is the rule, and patients whose lives can be prolonged with LT are dying of obesity-related comorbidities. Recent experience suggests that weight reduction in MO liver transplant recipients would improve their long-term survival. The bariatric surgery before LT is contraindicated for patients with decompensated cirrhosis, while post-transplant intervention is associated with increased technical difficulty. We present our experience with three patients who underwent simultaneous liver transplantation and sleeve gastrectomy. After a median 13 months follow-up, all patients are alive, having normal allograft function and significant weight loss. Combined liver transplantation with simultaneous sleeve gastrectomy appears technically feasible and relatively safe in selected patients.

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Introduction

In recent two decades, non-alcoholic fatty liver disease (NAFLD), that ranges from simple steatosis to non-alcoholic steatohepatitis (NASH), liver cirrhosis, and hepatocellular carcinoma (HCC), has emerged as one of most common causes of liver disease in the Western world [1, 2]. In the USA, NASH has already become the third most common indication for liver transplantation (LT) and epidemiological projections predict that in 2025 it will become the most common cause of liver failure requiring LT. Previously, many obese and virtually all morbidly obese (MO) patients (BMI ≥ 35–40 kg/m^2) were denied access to transplantation because of their high operative risk [2]. Recent experience suggests that sustained weight reduction in MO liver transplant recipients would likely improve their long-term survival. However, to date, there is little experience treating MO in transplant patients, and the best options for weight reduction in LT are still undetermined [3, 4]. From the proposed approaches, preoperative non-surgical dietary approach has been proven mostly ineffective. In surgical interventions, which require two separate sequential operations, bariatric surgery before LT is contra-indicated for patients with decompensated liver disease because of excessive morbidity and mortality, while post-transplant intervention may be associated with increased technical difficulty due to adhesions and complications related to long-term immunosuppression [4, 5]. In this report, we present our experience with an additional innovative approach in the care of the MO transplant recipient: the sleeve gastrectomy at the time of transplantation.

Methods

The study was approved by the institutional review board. Three patients who were unsuccessful with achievement of pre-transplant target weight (BMI < 35 kg/m^2), were planned for combined liver transplant and sleeve gastrectomy (LTSG). The strategy was planned ahead of time, and all patients were seen by the bariatric team as a part of the preparation for surgery, immediately after listing for LT. All three LTSG were performed using deceased donors, with a caval sparing hepatectomy and a duct-to-duct biliary anastomosis. After the uneventful completion of the liver transplantation, SG was performed by a bariatric surgeon (AK) utilizing a 42-French bougie with a sequential application of a 4.8 and 60-mm 3.5 Endo GIA stapler. After the operation, the nasojejunal feeding tube was left for enteral feeding. Once extubated, a contrast swallow study was performed and oral feeding was started. After discharge, patients were seen weekly by the hepatologist for the first 3 months and at 1, 3, 6, and 12 months by the transplant and bariatric surgery teams. The data for this study was collected retrospectively from patients' medical records.

Results

Three patients with a median BMI of 46.6 kg/m^2 and a median model for end-stage liver disease score (MELD) of 24 underwent a simultaneous LTSG. The demographics and outcomes are shown in Table 1. The mean total weight loss was 27.9% at a median follow-up of 13 months (range 3–24 months). None of the patients experienced any problems with immunosuppressive medications intake or graft rejection or dysfunction. Two of the patients had a complete remission of hypertension and diabetes. All three are currently alive with normal allograft function. In addition, none of the patients has steatosis based on protocol ultrasound performed for 2 out of 3 LT patients at 4 and 12 months. The addition to the total operative time for SG was around 40 min. One patient experienced two complications, one was a biliary leak that was treated by reoperation, and another one is a mild acute renal failure at 4 weeks post-operation, due to an overzealous diuretic use, both resolved without further consequences.

Discussion

In this report, we present our experience with an additional innovative approach in the care of MO liver transplant recipients: the sleeve gastrectomy at the time of transplantation.

Patients undergoing LT might suffer from NAFLD recurrence in the transplanted liver if their obesity is left untreated [5, 6]. Also, metabolic syndrome and inflammation caused by obesity may cause NASH and eventually cirrhosis in the transplanted liver. In the long term following liver transplantation, malignancies and cardiovascular causes account for a greater proportion of deaths as compared to immunologic or infectious causes. [6]. These conditions may be prevented if the obesity is treated. Both malabsorptive and restrictive bariatric procedures have been shown to decrease steatosis, ballooning, inflammation and fibrosis, and in some cases even lead to NASH resolution.

As NASH is becoming one of the leading causes of liver transplantation, and as experience with bariatric surgery grows, patients who had previously been considered inoperable can now undergo surgery with reasonable safety. Examples include octogenarians, adolescents, and patients with inflammatory bowel disease, all of which were considered contraindications for bariatric surgery and have lately been reported as feasible and successful. Among these are peri-transplant patients: cirrhotic patients awaiting transplantation and patients who already underwent transplantation. Nowadays, with the advancement in transplant medicine, the

Table 1 Demographics and bariatric outcomes

Patient	1	2	3
Sex/age	M/53	M/48	F/32
Liver disease	NASH Cirrhosis	HCV + HCC + NASH cirrhosis	Wilson disease + NASH
MELD	24	23	24
Preoperative weight/BMI	135/42.6	125/46.6	125/46
Last weight/BMI	95/30	88/30.4	94.5/33.9
Total weight loss (%)	29.6	29.6	24.4
DM	Resolved	Resolved	None
HTN	Resolved	Resolved	None
Complications	Biliary anastomosis leak, Transient ARF	None	None
Follow-up (month)	24	12	3

MELD model for end-stage liver disease, *DM* diabetes mellitus, *HTN* hypertension, *NASH* non-alcoholic stetohepatitis, *HCV* hepatitis C virus, *HCC* hepatocellular carcinoma, *ARF* acute renal failure

5 and 10 year graft survival rate is very high, and transplanted patients with prolonged survival are becoming susceptible to obesity-related comorbidities, mainly cardiovascular complications of the metabolic syndrome.

Among the factors taken into consideration while deciding upon the most suitable surgical option for a specific transplant patient are technical (the type of biliary anastomosis in a liver transplant patient, to allow for an early postoperative access to a biliary tree, drug absorption in malabsorptive procedures), medical (hyperparathyroidism in a dialysis patients, chronic anticoagulation or aspirin treatment), and others [4, 7–9].

Sleeve gastrectomy was preferred over gastric bypass surgery because of the decreased technical complexity and the absence of malabsorption, which may influence early post-transplant tacrolimus levels [8, 9]. The gastric band technique, previously reported in combination with LT [4], has been rejected as well, due to its limited efficacy in achieving weight loss as compared to gastric bypass surgery, as well as its potential for complications from a foreign body, and difficulties in accessing the biliary tract via an endoscopic route, if needed.

To the best of our knowledge, in the pertinent literature, there are only two reports describing combined LT and SG, in seven and in one patient, respectively [9, 10]. Heimbach et al. [9] compared the effectiveness of pre-transplant weight loss program in 37 patients, who achieved weight loss and underwent LT alone, and a combined LT plus sleeve gastrectomy in seven patients who failed to lose weight prior to LT. In those who received LT alone, weight gain to BMI > 35 was seen in 21/34, post-LT diabetes (DM) in 12/34, and steatosis in 7/34 of patients, with 3 deaths and 3 grafts losses. In patients underwent the combined procedure, there were no deaths or graft losses. One patient developed a leak from the gastric staple line, and one had excess weight loss. No patients developed post-LT diabetes or steatosis, and all had substantial weight loss (mean BMI = 29 kg/m^2). Tariciotti et al. [10] added another case of a MO patient with NASH cirrhosis, who had uncomplicated operative and postoperative course, and at 5 months after LTSG has significant weight loss, normal liver function tests and resolution of diabetes.

The timing of the BS in regards to LT deserves important consideration. It seems logical to perform a weight loss procedure in a morbidly obese transplant candidates, but this approach has a very strong downsize of operating on cirrhotic patients. A few studies have been published on cirrhosis and BS [4, 7]. When the Child-Pugh classification was used, almost all patients were Child A. Complications rated up to 34.8% have been reported, among them—portal vein thrombosis, liver decompensation, leaks, and mortality was 2–3 and 20 times higher in a Child A and B class, respectively, than in the general population [4, 7].

These patients pose a multidisciplinary challenge due to multiple comorbidities, usage of immunosuppressive agents, risk of graft dysfunction or rejection, and their history or current status as patients with insufficiency of one or more systems. Due to these limitations, these patients were considered inoperable, but are now beginning to enjoy the benefits of bariatric surgery. Therefore, the field of bariatric surgery in peri-transplant patients is a relatively new and evolving one.

This study shows preliminary results in a novel field but it has several limitations. First, the long-term efficacy of bariatric surgery in the peri-transplantation population cannot be deduced by the relatively short follow-up and small sample size. Extensive studies of larger groups with longer follow-up periods are needed in order to analyze the effect on graft and patient survival and function, as well as obesity-related comorbidities in this population. Nonetheless, these small sample's initial results suggest that bariatric surgery is effective and safe in the liver transplant population. The surgery induced effective weight loss and remission of obesity-related comorbidities.

These results are especially important because the prevalence of obesity is high among patients awaiting transplantation and following transplantation and is associated with a lower chance of undergoing transplantation, and increased risk of mortality and complications, increased graft-loss rates and shortened graft survival.

We conclude that despite the current controversies as to the timing and type of bariatric surgery in MO patients needing LT, the evidence suggests that definitive treatment of obesity is of such benefit to transplant recipients that an intervention at any time point is better than none. For the present, in view of increasing demand, we recommend the combined LTSG in carefully selected patients.

Compliance with Ethical Standards

Financial Support None.

Conflict of Interests The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Waiver of Informed Consent For this type of study formal consent is not required.

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