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CASE REPORT

Simultaneous living donor liver transplant with sleeve gastrectomy for metabolic syndrome and NASH-related ESLD—First report from India

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Abstract Nonalcoholic steatohepatitis (NASH) with morbid obesity and metabolic syndrome is now a common cause of end-stage liver disease (ESLD). These patients are high-risk candidates for liver transplant, and require bariatric surgery to prevent recurrent disease in the new liver. Data reports bariatric surgery after transplant, which maybe difficult because of adhesions between the stomach and liver in living donor liver transplant (LDLT) recipient. We report the first case of combined LDLT with sleeve gastrectomy (SG) from India. A morbidly obese diabetic woman with NASH-related ESLD was planned for combined right lobe LDLT with open SG, in view of failed diet therapy, musculo-skeletal complaints, and restricted mobility. Postoperatively, with liver graft functioning adequately, bariatric diet restrictions resulted in maximum reduction of 25% weight, achieving a target BMI below 30 kg/m^2 within 2 months, along with complete cure of diabetes and better ambulation. Thus, combination of LDLT and bariatric surgery in the same sitting is safe and effective in management of metabolic syndrome and associated NASH-related ESLD.

Keywords Bariatric surgery · Combined procedure · India · LDLT · Right lobe

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Introduction

Nonalcoholic steatohepatitis (NASH) is becoming an increasingly common cause of cirrhosis of the liver and hepatocellular carcinoma [1]. These patients are often obese with various metabolic derangements and thus constitute high-risk candidates for major surgery like liver transplant. If they do recover from the transplant, they have a tendency to get recurrent disease in the new liver; between 4% to 33% have risk of posttransplant recurrent steatohepatitis over 6 weeks to 20 years period [2].

Bariatric surgery has been shown to reverse NASH [3]. Thus, liver transplant combined with bariatric surgery is the way forward to reduce incidence of recurrent NASH, also to tackle the metabolic complications associated. Morbidly obese patients with decompensated cirrhosis may be better served in the long-term if they have bariatric surgery during the liver transplant. Adhesions between the stomach and the liver, particularly if the transplant is living donor, may make subsequent bariatric surgery difficult, dangerous, or even impossible.

Most reported series involve bariatric procedures are done secondarily to deceased donor liver transplants. The Mayo Clinic has reported a series of such combined operations with good outcomes [4]. We report the first case of a combined living donor liver transplant (LDLT) with sleeve gastrectomy (SG) from India.

Case report

A 58-year-old morbidly obese female presented with a NASH-related decompensated end-stage liver disease (ESLD). Diagnosed incidentally 6 months ago, she had recurrent

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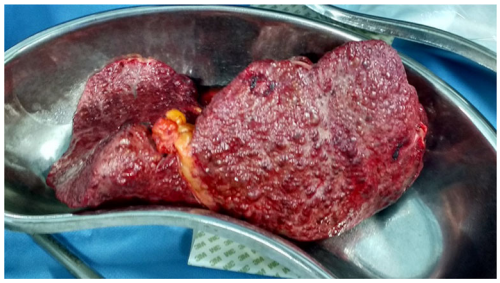

Fig. 1 Explanted cirrhotic liver

episodes of hepatic encephalopathy, hepatorenal syndrome, ascites, and hydrothorax as decompensation. Upper gastrointestinal endoscopy and variceal band ligation was done in the past. With a Child-Pugh score of 10 (C) and model for end-stage liver disease (MELD) score 27 (MELD Na 32) at first presentation, she was advised LDLT. She was also a known case of type 2 diabetes mellitus, hypertension, and hypothyroidism, on treatment for the 5 years. Due to her obesity, she also suffered from arthritis, musculo-skeletal pain with L5-S1 lumbar canal stenosis, requiring minimally invasive micro-decompression. This had greatly reduced her mobility and she was hence considered a poor candidate for medical management of obesity.

At first presentation for transplant work-up, she weighed 91.5 kg, with a body mass index (BMI) of 36.65 kg/m^2. Hence, consultation with the bariatric surgery team was also done alongside, and decision taken to proceed with simultaneous LDLT and open SG. However, nearing her transplant date, she developed bilateral granulomatous parotitis, compelling the deferral of her planned surgery. At this admission however, her weight had increased to 99 kg, with a BMI of 39.15 kg/m^2. Preoperatively, she was counseled regarding diet, and started on salt restricted low-calorie high protein diet (calorie =25 Kcal/kg bw; protein =1 g/kg bw). Since ambulation was difficult for her, exercise was restricted to sedentary limb physiotherapy. Finally, about 3 weeks later, she was taken up for the combined procedure. Her weight had not shown any significant reduction in spite of supervised dietary modification and remained at 98 kg (BMI–38.76 kg/m^2).

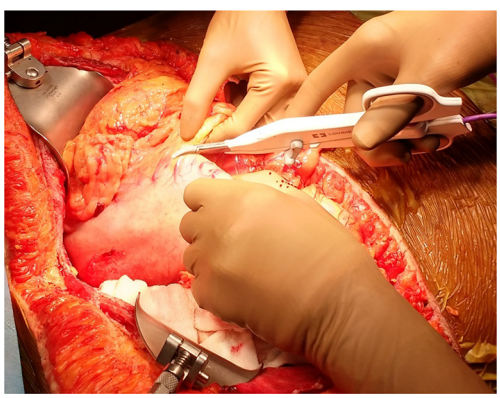

Fig. 2 Devascularization of greater curvature

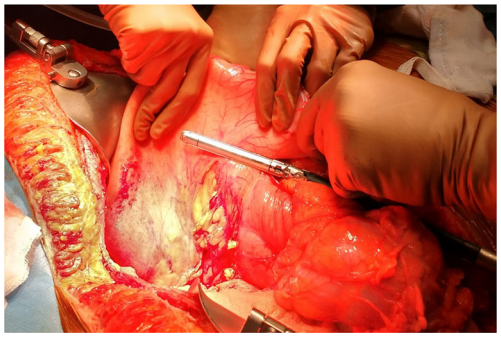

Fig. 3 Articulating stapler firing for resection of gastric sleeve

LDLT was carried out using right lobe with subtotal MHV as graft (Fig. 1). Graft-recipient weight ratio (GRWR) was an acceptable 0.64. Adipose tissue has a low metabolic requirement and we accept low graft recipient weight ratios in obese patients for this reason. Autologous portal vein extension graft was utilized to reconstruct the middle hepatic vein. Reperfusion was uneventful. 2:1 duct-to-duct anastomosis was done. After completion of the biliary anastomosis and the intraoperative Doppler study of vascular flows, the bariatric surgery team took over and performed a SG. The greater curvature of the stomach was devascularized using Ligasure™, ensuring no lateral injury (Fig. 2). A 36 Fr gastric calibration tube was passed across the pylorus, and the stomach divided using EndoGIA™ stapler with a height of 4.8 mm (purple) (Figs. 3, 4 and 5). Postresection methylene blue leak test was negative. Total operative time for two procedures was 10 h and 2 min.

Postoperative recovery was uneventful. Oral sips were started from the second day after negative gastrografin study. Third day onwards, she was tolerating clear liquids at 50–100 mL/h. She was given strict liquid diet for mandatory 14 days, after which she was on high-protein low-carbohydrate soft diet till discharge. Her dietary calorie count was between 1000 and 1100 Kcal/day with proteins of 60 g/day. Her liver parameters were responding adequately to triple immunosuppression regime with no rejection or sepsis. The only

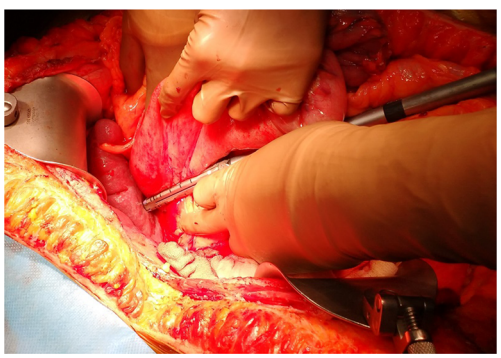

Fig. 4 Last stapler firing to finish the sleeve gastrectomy

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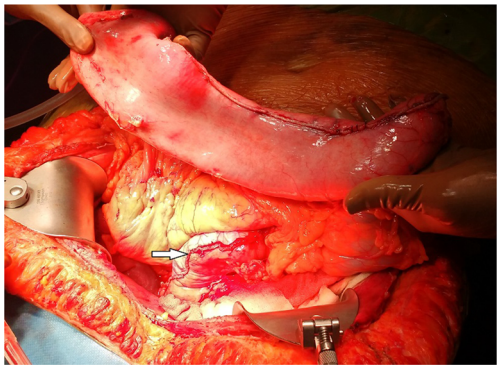

Fig. 5 Resected stomach tube with *arrow* showing gastric staple line

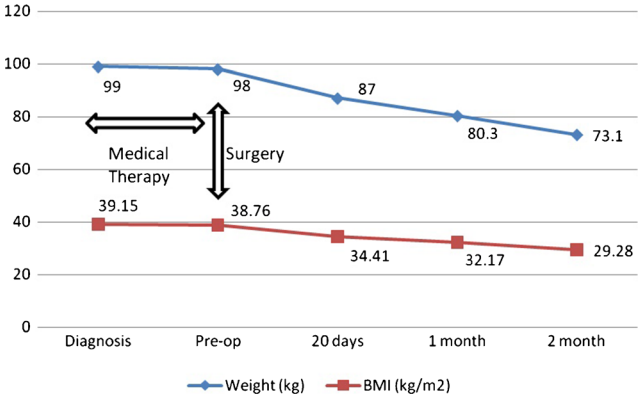

Fig. 6 Comparitive changes in weight and BMI before and after procedure

matter of concern was the persistent ascitic output in drain, which had dropped from about 1.5 to 400 L per day at discharge. Although blood sugars and insulin requirement had increased in the immediate postoperative period owing to steroid therapy, her blood pressures were well under control. When planned for discharge on 20th postoperative day, she weighed 87 kg, with a BMI of 34.41 kg/m^2 (reduction of 11%).

The patient was followed up by the liver team biweekly for a total of 2 months. Any changes in enzymes, immunesuppressant levels were monitored, but they remained within acceptable range. During her first month follow up visit to the bariatric team, she weighed 80.3 kg (BMI–32.17 kg/m^2) suggesting a reduction of 18% from preoperative weight. By this time, she was completely off oral and injectable antidiabetic therapy, with highest blood sugars no more than 120 mg/dL. At her last follow up after 2 months, her weight had further reduced to 73.1 kg (BMI–29.28 kg/m^2), a 25% reduction in weight and BMI, and was ambulatory without assistance (Table 1) (Fig. 6).

Discussion

The incidence of obesity and associated metabolic syndrome is on the rise in the Indian subcontinent, with parallel surge in related complications, including NASH [5]. With the advent of bariatric surgery, a definite solution was sought for those in whom lifestyle modifications had failed and medical management was not an option. NASH, defined as ≥5% hepatic steatosis in the absence of other underlying liver diseases, is the cause of nearly 25% to 45% of ESLD worldwide [6]. Morbid obesity with metabolic syndrome is seen in about 50% to 60% of liver transplantation population [7], and is associated with increased incidence of primary graft nonfunction and early postoperative mortality [8].

Dealing with ESLD and metabolic syndrome would require not only a new healthy liver, but the control of metabolic derangements and adequate weight reduction in the postoperative period. In fact, NASH is known to relapse posttransplantation if the patient regains weight [9]. The several drugs available for weight loss have not been approved for use in cirrhotic patients. In addition, interactions between these medications and immunosuppressant drugs are yet unknown [10]. Bariatric surgery has been proven to be the most effective treatment for morbid obesity and its related conditions with highest chances of long-term control [11]. Few studies have been published highlighting bariatric surgeries and liver transplant performed at different intervals. Where seven papers have studied bariatric surgeries after deceased donor liver transplant, only one major case series from the Mayo Clinic exists for simultaneous combined procedures, which includes predominantly deceased donor liver transplants [4, 12]. The outcomes of all series are good and comparable to each other with respects to liver graft functions, weight loss, and control of metabolic derangements.

Table 1 Variations in physical and metabolical parameters before and after procedure

Parameters	At diagnosis	Preoperative	20 days	1 month	2 months
Weight (kg)	99	98	87	80.3	73.1
BMI (kg/m2)	39.15	38.76	34.41	32.17	29.28
Max FBS (mg/dL)	235	190	200	136	114
BP meds	1	1	1	0	0
Mobility	Wheelchair	Wheelchair	Walker	Walker	Ambulant
Diet compliance	Liquid diet	Liquid diet	Poor	Good	Good

Max FBS maximum fasting blood sugar

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One matter of concern when opting for living donor grafts for morbidly obese recipients is the risk of small-for-size and the need to maintain adequate GRWR. We selectively accept GRWRs of up to 0.6. The factors which determine the acceptability of a low GRWR include the composition of the patient's body weight. For instance, ascites and massive edema increase the weight without increasing the requirement of liver volume. Similarly, patients with a greater proportion of body fat have a lower metabolic requirement that those with muscle and lean body mass [13]. The basal metabolic rate has been shown to be proportional to the fat-free mass of patients [14]. An additional factor to consider is the severity of portal hypertension for which the size of the spleen and the platelet count are simple surrogates [13]. We routinely take right lobe grafts with the middle hepatic vein to optimize venous outflow. Other centers have also reported that the GRWR can be safely reduced to 0.6% in selected cases [15]. Despite the factors discussed above, body mass does limit the applicability of a living donor liver transplantation to morbidly obese patients. However, in countries like India, with low deceased donation rates, it remains a viable option.

Transplant surgeons have been reluctant to combine bariatric procedures with transplant in the same sitting because of the small risk of leakage from the gastric staple line. Lazzati et al. had reported an incidence 14.3% of staple line leaks post-SG, attributing to immune-suppression, and poor nutritional status [12]. However, in the long-term, the patient may be better served by a combined procedure since it would eliminate the risk of recurrence of NASH. Doing a bariatric procedure after liver transplant, it may be difficult due to adhesions between the stomach and liver. This is particularly so in a right lobe living donor liver transplant where the stomach tends to drape itself over the cut surface of the liver, making the bariatric procedure nearly impossible.

Another technique that has been described in this context for weight reduction is preoperative intragastric balloon insertion prior to planned living donor liver transplants [16]. A case report also describes a simultaneous adjustable gastric band placement along with deceased donor liver transplant [17], both of which have achieved acceptable weight reduction. However, the weight reduction using this technique is of short duration and one would anticipate these patients developing recurrent NASH in the new liver. Roux-en-Y gastric bypass, although widely popular, has not gained significant favor to be combined along with liver transplant. Roux-en-Y gastric bypass has a malabsorptive component, and hence would require multiple immunosuppressant dose adjustments, unlike SG [18]. Also, it involves alterations in gastrointestinal anatomy, making future endoscopic interventions impossible. This has also been reported to cause increased serum ammonia levels leading to hepatic encephalopathy [19].

In our study, the first such reported in a LDLT recipient from India, we have combined a standard right lobe living donor liver transplant with open SG. Apart from adequate graft function, postoperative period was characterized by achieving a weight loss of 25%, thereby attaining the target BMI <30 kg/m^2. Moreover, diabetes control was obtained, along with improved general condition and mobility in a previously bed-ridden patient.

We conclude that combined LDLT with SG is an effective and safe modality in the management of metabolic syndrome with NASH-related ESLD, with better postoperative results and reduced risks of complications. However, we need more experience with longer follow up duration for better understanding of clinical outcomes.

Compliance with ethical standards

Conflict of interest SK, NK, AK, KY, SS, SS, AC, SK, VV, JP, and VK declare that they have no conflicts of interest.

Ethical approval All procedures performed in the study were in accordance with the ethical standards of the institution. Informed consent was obtained from the patient for publishing this study.

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