The Obese Liver Donor

Authors: AnnMarie Liapakis, MD and Vineeta Kumar, MD

Editor: Tarunjeet Klair, MD

ISSUE

What are the requirements and concerns for a potential live liver donor with obesity?

DATA

Obesity is defined by body mass index (BMI) calculated using an individual's height (in meters) and weight (in kilograms) as kg per meter squared (kg/m^2). A normal BMI is 18.5-24.9, overweight is 25-29.9, and obese >30.(1) Obesity if further classified as class I (BMI 30.0-34.9), class II (35-39.9), and class III (40.0 +) representing incremental disease risk.(2)

Obese living liver donor candidates are being commonly encountered given the high prevalence of obesity in the general population which was reported at 39.8% in 2015-16 per Center for Disease Control and Prevention (CDC) data.(3) In a worldwide survey of transplant centers that perform living donor liver transplants, the median BMI cut off was 33 at high volume centers and 30 at low volume centers.(4)

Obesity itself may be a risk factor for complications such as prolonged resection time, blood loss, & pulmonary complications in the setting of surgery such as liver resection i.e., donation.(5) It is a known risk factor for development of incisional hernia and poor wound healing.(6 ,7) However risk is most accurately assessed with consideration of body fat distribution, liver steatosis (liver fat content), and metabolic profile (sugar, cholesterol, and blood pressure), rather than BMI alone.

Correlation between obesity and liver steatosis is imperfect. Liver steatosis is more accurately predicted by visceral fat area (deep fat within the abdomen surrounding the vital organs) and triglycerides (a type of cholesterol), than BMI.(8)

Metabolic syndrome is defined when a person has 3 or more of the 5 following criteria: 1. waist circumference >40 inches in males or >35 inches in females, 2. elevated blood sugar (fasting glucose >/= 100mg/dl, abnormal cholesterol panel with 3. high cholesterol (triglycerides >150mg/dl) or 4. low (HDL cholesterol <40mg/dl males or <50 mg/dl females), 5. high blood pressure (>130mmHg systolic or >85mmHg diastolic).(9)

Metabolic syndrome is a risk factor for type 2 diabetes, cardiovascular (heart) disease, and liver steatosis, and is associated with a significant increase in risk of complications with surgery such as liver donation.(10) Diabetes impacts the ability of the liver to regenerate.(11) Significant liver steatosis (>30%) and steatohepatitis (liver fat with inflammation) can impair how the liver functions when transplanted to a recipient and may also result in progressive liver fibrosis (scarring) in both the donor and recipient.(12)

“Healthy” obese donors (those without metabolic derangements and cardiovascular issues) have similar complication rates, liver function, and hospital stays after donation compared to non-obese donors.(13, 14)

There is data to support that donor livers with up to 20-30% steatosis without metabolic abnormalities, liver inflammation, and fibrosis can safely undergo right lobe donation provided the graft-to-weight-recipient ratio and future liver remnant is adequate.(15-18)

Generally, centers evaluate the BMI and metabolic profile of potential donors together. Most centers exclude potential donors with metabolic syndrome and/or diabetes.

There is no absolute cut-off for donor BMI. Though most transplant centers exclude potential donors with a BMI >35. For obese donors metabolic work-up and assessment of liver fat content either via MRI or liver biopsy is appropriate*.(19)

Obesity and metabolic syndrome are modifiable i.e., they can be reversed with appropriate therapy. The mainstay of treatment recommendations is lifestyle intervention with diet, exercise, and smoking cessation if present. Dietary treatment consists of a reduction of calorie intake and low-fat food choices. Metabolic parameters may be improved with a reduction of >7% body weight.(20) Lifestyle changes need to be sustained over the long term otherwise weight will be regained. Pharmacologic therapy i.e., medications, and/or meal replacement programs may be considered in the appropriate setting. Excluded persons who have achieved successful weight loss may be reconsidered as live liver donors.

Surgery is a later stage treatment option for obesity (bariatric surgery). Potential donors who have had prior bariatric surgery may be considered dependent on the type of operation performed (laparoscopic adjustable gastric band or gastric sleeve rather than gastric bypass) and whether sustained weight loss to goal BMI has been achieved.(21)

Some transplant centers are exploring formalized weight/metabolic treatment programs to assist potential donors in achieving weight loss and optimal health.

RECOMMENDATIONS

1. Obesity is not an absolute contra-indication to liver donation. Though class II obesity with BMI >35 is generally considered a relative contraindication. Obese potential live liver donors should undergo assessment of visceral fat, metabolic profile, and liver steatosis.
2. Those with liver steatosis >30% and/or metabolic syndrome are at increased risk.

3. Those with mild liver steatosis and/or an abnormal metabolic parameter should be optimized via life style modification and therapy as appropriate with a follow-up assessment confirming improvement of metabolic profile and fat fraction by validated means prior to surgery.
4. Long-term follow-up of obese liver donors should be instituted to assess for potential weight gain and development of NASH as this data is currently lacking.

See chapter: “The Role of Liver Biopsy in the Potential Live Liver Donor”

REFERENCES

1. https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html. Retrieved 3 October 2019.
2. https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmi_dis.htm. Retrieved 3 October 2019.
3. https://www.cdc.gov/obesity/data/adult.html. Retrieved 3 October 2019.
4. Soin AS, Chaudhary RJ… A worldwide survey of live liver donor selection policies at 24 centers with a combined experience of 19009 adult living donor liver transplants. Transplantation 2019; 103:e39-e47
5. Ri M, Aikou S, Set U. Obesity as a surgical risk factor. Annals of Gastronterological Surgery. 2018; 2:13-21. 13-21.
6. Sugerman HJ, Kellum JM Jr, Reines HD, et al. Greater risk of incisional hernia with morbidly obese than steroid-dependent patients and low recurrence with prefascial polypropylene mesh. Am J Surg 1996;171:80-4.
7. Wick EC, Hirose K, Shore AD, et al. Surgical site infections and cost in obese patients undergoing colorectal surgery. Arch Surg 2011;146:1068-72.
8. Lee HW, Kim KJ, Jung KS, et al. The relationship between visceral obesity and hepatic steatosis measured by controlled attenuation parameter. PLOS ONE. Oct 27, 2017. https://doi.org/10.1371/journal.pone.0187066
9. Huang PL. A comprehensive definition for metabolic syndrome. Disease Models & Mechanisms. 2009 May-Jun;2(5-6):231-237.
10. Bhayani NH, Hyder O, Frederick W, et al. Effect of metabolic syndrome on perioperative outcomes after liver surgery: A National Surgical Quality Improvement Program (NSQIP) analysis. Surgery. 2012 Aug; 152(2):218-226.
11. Mendes-Braz M, Martins JO. Diabetes mellitus and liver surgery: the effect of diabetes on oxidative stress and inflammation. Mediators of Inflammation. 2018 May 8; 2018:2456579.
12. Marsman WA, Wiesner RH, Rodriguez L, Batts KP, Porayko MK, Hay JE, Gores GJ, Krom RA. Use of fatty donor liver is associated with diminished early patient and graft survival. Transplantation. 1996; 62:1246–1251.
13. Knaak M, Goldaracena N, Doyle A, et al. Donor BMI >30 Is Not a contraindication for live liver donation. American Journal of Transplantation 2017; 17: 754–760.
14. Moss J, Lapointe-Rudow D, Renz JF, et al. Select utilization of obese donors in living donor liver transplantation: Implications for the donor pool. American Journal of Transplantation2005; 5: 2974–2981

15. Bhangui P, Sah J, Choudhary N, et al. Safe use of right lobe live donor livers with up to 20% macrovesicular steatosis without compromising donor safety and recipient outcome. Transplantation: June 25, 2019 - Volume Online First - Issue
16. Lee SG. A complete treatment of adult living donor liver transplantation: A review of surgical technique and current challenges to expand indication of patients. American Journal of Transplantation 2015; 15: 17–38
17. Soejima Y, Shimada M, Suehiro T, et al. Use of steatotic graft in living-donor liver transplantation. Transplantation: July 27, 2003 - Volume 76 - Issue 2 - p 344-348
18. Cho JY, Suh KS, Kwon CH, et al. The hepatic regeneration power of mild steatotic grafts Is not impaired in living-donor liver transplantation. Liver Transplantation February 2005; 11(2): 210-217.
19. Lee JY, Kim KM, Lee SG, Yu E, Lim YS, Lee HC, Chung YH, Lee YS, Suh DJ. Prevalence and risk factors of non-alcoholic fatty liver disease in potential living liver donors in Korea: a review of 589 consecutive liver biopsies in a single center. J Hepatol. 2007 Aug; 47(2):239-44
20. Promrat K, Kleiner DE, Niemeier HM, et al. Randomized controlled trial testing the effects of weight loss on nonalcoholic steatohepatitis. Hepatology. 2020:51(1):121.
21. https://www.niddk.nih.gov/health-information/weight-management/bariatric-surgery/types

For more information on Living Liver Donation, please refer to our website, generously supported by Novartis.