



Weight Gain Trajectory Predicts Long-term Overweight/Obesity after Pediatric Liver Transplant

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Background

Long-term survival after pediatric liver transplant is excellent with >80% of children alive at 5-10 years.^{1,2} However, up to 50% are overweight or obese.³ Post-transplant nutritional counseling has traditionally encouraged vigorous weight gain, but data on obesity onset and predictors is needed to minimize long-term morbidity.

Objective

Assess anthropometric trajectories of pediatric liver transplant recipients to identify early predictors of long-term overweight/obesity.

Methods

Retrospective single-center study of children aged 0-6 years at transplant who were transplanted between 1994-2013 and had available anthropometrics. BMI, weight, and height percentiles were calculated using World Health Organization standards. BMI percentile was used to define underweight (BMI <5th percentile), normal weight (BMI 5-85th percentile), and overweight/obese (BMI >85th percentile). Children were grouped by BMI status at 3 years post-transplant. BMI and weight gain trajectories were examined as predictors of overweight/obesity at 3, 5 and 10 years post-transplant. Groups were compared using chi-squared and Kruskal-Wallis tests.

Results

Overall cohort

Children (n=54) were median 0.9 years old at transplant (IQR 0.6-1.8), transplanted most commonly for biliary atresia (46%), genetic/metabolic conditions (22%), acute liver failure (13%), and cholestatic conditions (11%). Calcineurin-inhibitor and steroid induction followed by taper was utilized for all patients for 3-6 months post-transplant only. Median BMI percentile increased from 37th (IQR 11– 74) at transplant to 83rd (IQR 64– 97) at 12 months, though median weight percentile remained below the 50th (median: 47th; IQR 35 - 83) and height percentile was even lower (median: 14th; IQR 3- 50). Overweight/obesity prevalence peaked at 3 years post-transplant at 44%, and stabilized to 26% at 5 years and 28% at 10 years. Overweight/obesity at 6 and 12 months was associated with overweight/obesity at 3 years (p = 0.013 and 0.007).

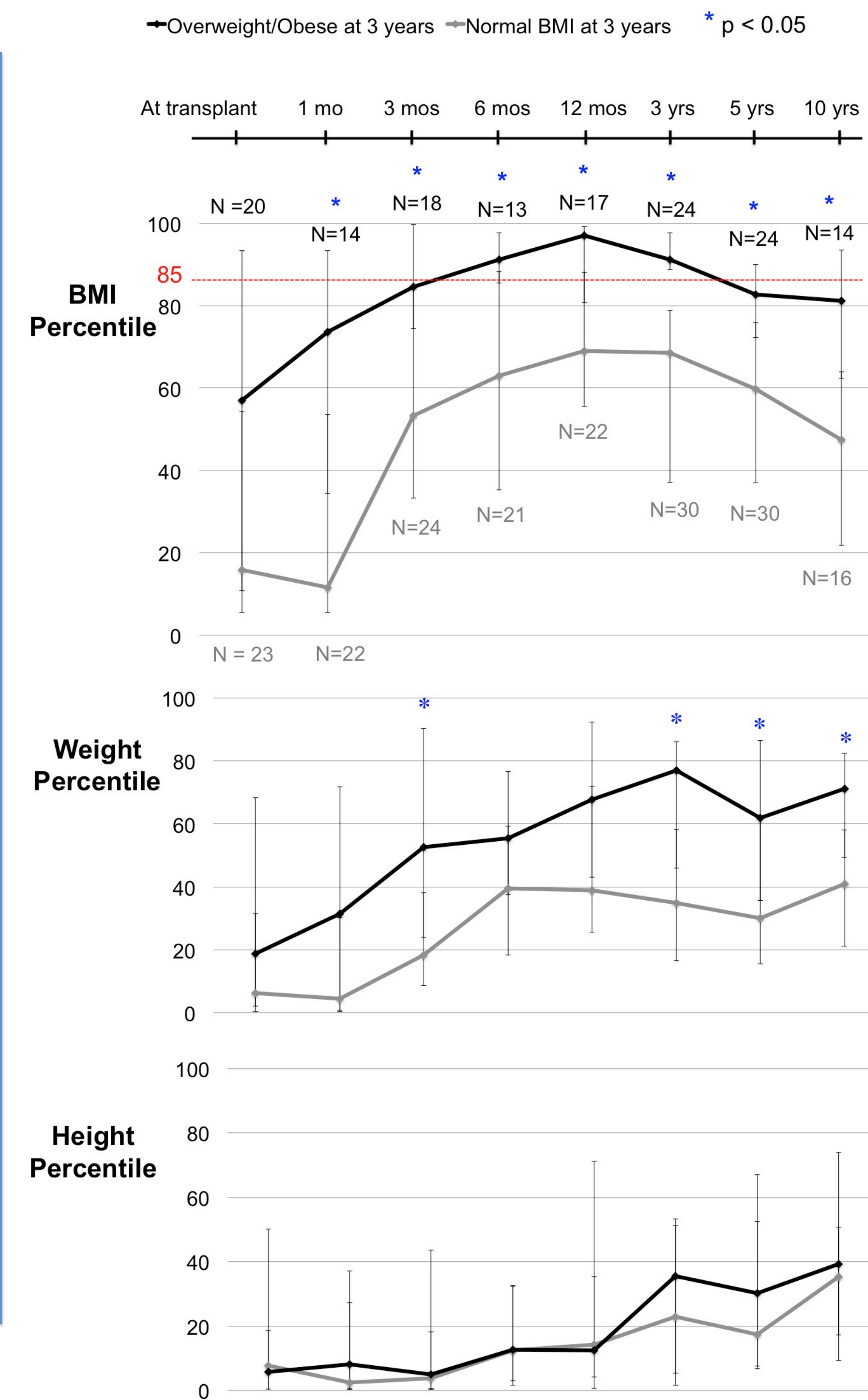
Comparing growth trajectories by BMI status at 3 years

As early as 1 month post-transplant, BMI percentile in children who were overweight/obese at 3 years was higher (median: 74th; IQR 34-93) than in those of normal BMI at 3 years (median: 12th; IQR 6-54). For those overweight/obese at 3 years, median weight percentile increased steadily from transplant (19th) to 3 years (77th). For those normal weight at 3 years, median weight percentile increased from 6th to 40th over the first 6 months and then plateaued. Height percentiles overlapped at every timepoint for those normal and overweight/obese, and median peaked at 10 years (40th). Sex, race/ethnicity, age at transplant, and transplant indication were not associated with overweight/obesity at 3 years. Of children who were failure-to-thrive (FTT) at transplant, 44% were overweight/obese at 3 years, while 45% of non-FTT children were overweight/obese at 3 years (p=0.95).

Characteristics of pediatric liver transplant cohort, by BMI status at 3 years post-transplant

	Normal BMI N = 30	Overweight/ Obese N = 24	p
Sex			
Female	50%	48%	0.76
Male	50%	52%	
Age at Transplant			
< 1 year	60%	58%	0.99
1-2 years	17%	17%	
2-5 years	23%	25%	
Race			
Caucasian	23%	54%	0.08
African-American	10%	0%	
Asian	27%	21%	
Other/Unknown	40%	25%	
Ethnicity			
Latino	27%	37%	0.39
Not Latino	73%	63%	
Diagnosis category			
Biliary atresia	40%	54%	0.52
Metabolic disease	20%	25%	
Cholestatic conditions	17%	4%	
Acute liver failure	13%	13%	
Donor Type			
Deceased donor	80%	63%	0.15
Living-related	20%	37%	
Organ transplant type			
Whole liver	40%	29%	0.35
Split liver (deceased donor)	40%	33%	
Partial liver (living-related)	20%	38%	

BMI, weight and height percentile trajectories for pediatric liver transplant recipients by BMI status at 3 years post-transplant



Discussion

Overweight/obesity affects nearly half of pediatric liver transplant recipients, as shown previously.^{5,6} This study provides new evidence about risk factors for becoming overweight/obese after transplant.

- Most children gain weight rapidly post-transplant, and those who become overweight/obese tend to do so within the first year post-transplant.
- Becoming overweight/obese within the first year post-transplant is a significant risk factor for long-term overweight/obesity. The children who were overweight/obese at 3 years were likely to have a BMI percentile exceeding the 85th percentile by 6-12 months post-transplant.
- Linear growth catch-up is a challenge for most children post-liver transplant, regardless of BMI percentile post-transplant.

Limitations of the study include the retrospective nature and relatively small sample size. Missing data on heights or weights prevented calculation of BMI percentile for all patients at every timepoint, further limiting sample size.

Conclusion

Overweight/obesity within the first year after liver transplant is a risk factor for persistent overweight/obesity. Careful nutritional counseling and follow-up is required because weight gain outpaces linear growth for most children.

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