

Background and Objectives

- Diabetes mellitus (DM) is a chronic condition resulting from the dysregulation of blood glucose levels. Statistics from 2015 describe the significance of diabetes in the United States, citing prevalence as high as 9.4 percent of the population. Of the 30.3 million documented cases, 30.2 million include individuals in the adult demographic aged 18 or older.¹
- Previous studies and current investigations have both suggested that weight loss is more difficult to achieve in patients with diabetes. Many of the approaches to weight loss prescribed to diabetic patients deliver results in the short term, but prove difficult to sustain in the long term.
- A sleeve gastrectomy is a surgical procedure designed to remove a large portion of the stomach, commonly to induce weight loss.² With 30-day mortality and complication rates below one percent, the gastric sleeve has proven to be a safe weight-loss intervention.³ The effectiveness of sleeve gastrectomy as a weight loss solution in the short and intermediate term has been demonstrated reliably.

Methods

- Objective:** To evaluate improvement and resolution of Diabetes Mellitus after sleeve gastrectomy
- Design:** Retrospective chart review
- Population:** Male and female adult patients (18-89 years old) with DM who underwent sleeve gastrectomy
- Setting:** Banner Gateway and Banner Estrella Bariatric Surgery Centers
- Time frame:** January 1, 2015 - December 31, 2015
 - Data points:** Pre-op, 2 week, 1, 3, 6 month, and 1 year
- Measurements:** prescribed medications, Hemoglobin A1C, excess weight loss (EWL), body mass index (BMI)
- Primary Outcome:** Normal hemoglobin A1C values (≤ 5.7%)
- Statistical Analysis:** Wilcoxon Rank Sum Test (continuous variables), Chi-squared/Fisher's exact, Generalized Estimating Equation (association between clinical values and likelihood of diabetes resolution), Kaplan-Meier Statistic (probability of resolution)
 - Resolution will be determined by improvement in aforementioned physiologic measurements

IRB Approval from Banner Health (Project ID: 0004299)

¹National diabetes statistics report, 2017. *National Center for Chronic Disease Prevention and Health Promotion*. 2017:1-19.

²Koliaki C, Liatis S, le Roux CW, Kokkinos A. The role of bariatric surgery to treat diabetes: Current challenges and perspectives. *BMC Endocr Disord*. 2017;17(1):6. doi: 10.1186/s12902-017-0202-6 [doi].

³Moon RC, Kreimer F, Teixeira AF, Campos JM, Ferraz A, Jawad MA. Morbidity rates and weight loss after roux-en-Y gastric bypass, sleeve gastrectomy, and adjustable gastric banding in patients older than 60 years old: Which procedure to choose? *Obes Surg*. 2016;26(4):730-736. doi: 10.1007/s11695-015-1824-2

Results

Predictors	OR (95% CI)	P-Value
Diabetes		
Non-Insulin	REF	
Insulin	0.19 (0.08, 0.48)	<0.001
Time		
2 Weeks	REF	
1 Month	1.11 (0.79, 1.56)	0.53
3 Months	1.58 (0.99, 2.52)	0.055
6 Months	2.47 (1.36, 4.47)	0.003
1 Year	6.97 (2.78, 17.5)	<0.001

Table 1. Odds ratio (95% CI) calculated using the Generalized Estimating Equation to ascertain the likelihood of resolution over time

	Overall N=80	Non-Insulin N=51	Insulin N=29	P-value
Diabetic Resolution (%)	38	29	9	0.02
2 Weeks (n=78)	(48.7)	(58.0)	(32.1)	0.008
1 Month (n=76)	38	30	8 (29.6)	<0.00
3 Months (n=70)	(50.0)	(61.2)	7 (26.6)	1
6 Months (n=53)	38	31	6 (35.3)	0.001
1 Year (n=30)	(54.3)	(70.5)	4	0.03
	35	29	(57.1)	
	(66.0)	(80.6)		
	26	22		
	(86.7)	(95.6)		
A1C, % mean (SD)	6.29 (0.86)	5.95 (0.35)	6.88 (1.14)	<0.001
BMI at Time of Resolution, kg/m² mean (SD)	35.8 (5.82)	36.1 (6.24)	35.1 (5.09)	0.56
Excess Weight Loss, % mean (SD)	43.7 (15.1)	44.3 (16.1)	42.7 (13.6)	0.82

Table 2. Resolution at each time point reported as number of individuals advancing beyond the need of diabetic

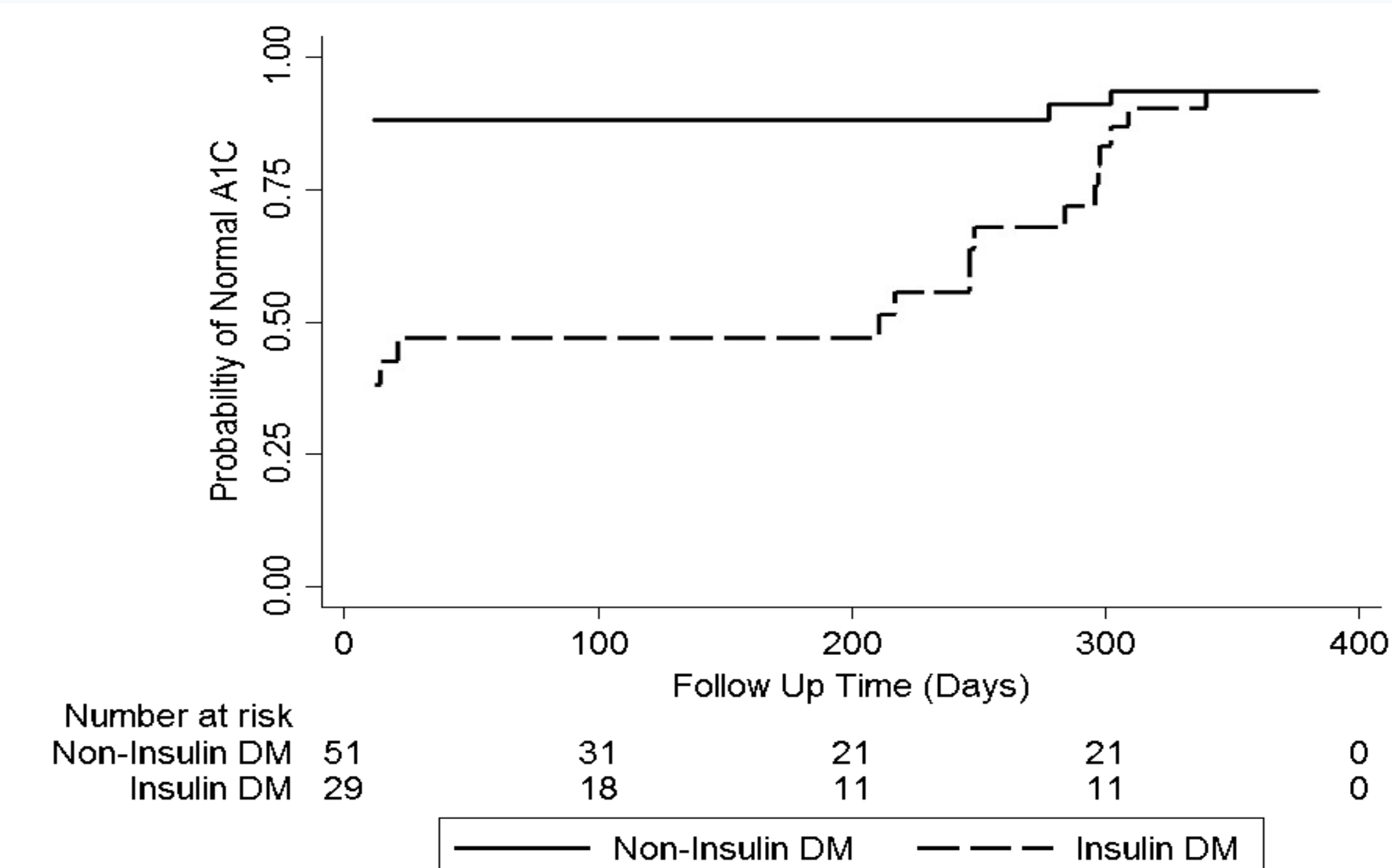


Figure 1. Associating time post-op with return to physiologically normal A1C values.

Summary and Conclusion

- Time was a significant predictor of diabetic resolution after six months post-op in patients who originally presented with Type 1 DM (**Table 1**).
- Change in hemoglobin A1C values held a significant association to resolution of Type 1 diabetes (**Figure 1**) while BMI and EWL displayed a positive correlation that failed to reach statistical significance (**Table 2**).
- There are differences between the post-operative improvements in diabetic status following sleeve gastrectomy depending on the initial diagnosis of insulin-dependent or insulin-independent DM.
 - Pathophysiological mechanism of a patient's diabetic condition, specifically auto-immune destruction of pancreatic beta cells, may contribute to the variable metabolic response following sleeve gastrectomy.
- Future research is necessary to standardize LSG as an equally effective metabolic therapy for both Type 1 and Type 2 DM. The research question may also be approached from a sex-specific or age-specific perspective to accurately identify the likelihood of resolution in various patient