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DiaRem score: external validation

Ali Aminian, **Stacy A Brethauer**, **Sangeeta R Kashyap**, **John P Kirwan**, and **Philip R Schauer**
Bariatric and Metabolic Institute (AA, SAB, PRS), and Endocrinology and Metabolism Institute (SRK, JPK), Cleveland Clinic, Cleveland, OH 44195, USA

Philip R Schauer: schauep@ccf.org

Christopher Still and colleagues[1] have produced a novel scoring system (DiaRem score) to predict the probability of remission of type 2 diabetes after Roux-en-Y gastric bypass (RYGB) surgery. Determination of predictive factors of diabetes remission after weight-loss surgery has been of great scientific and clinical interest to bariatric and metabolic surgeons for the past decade. In 2003, Schauer and colleages[2] noted that patients with a longer preoperative duration of type 2 diabetes, advanced disease (ie, use of insulin), and lower weight loss after surgery were least likely to achieve resolution of type 2 diabetes after RYGB.[2] Although several studies confirmed these findings, until now the presence of a valid, simple, and reproducible model to predict the outcome of type 2 diabetes after bariatric surgery and help decision making had not been reported. The DiaRem score, which is based on a retrospective study of 690 patients with diabetes (most were followed up for ≤2 years), was created using a Cox regression model, and four preoperative clinical variables were identified in the final scoring model: insulin use, age, HbA_{1c}, and type of antidiabetic drugs used. On the basis of the DiaRem score (ranging from 0 to 22), patients were classified into five groups (table).[1]

Our team at the Cleveland Clinic recently published data on the long-term metabolic effects of bariatric surgery in a cohort of diabetic patients.[3] Definitions of complete remission (HbA_{1c} <6%, off diabetic medications) and partial remission (HbA_{1c} 6–6·4%, off diabetic medications) of type 2 diabetes were similar to Still and colleagues' criteria. We assessed long-term (>5 years) clinical outcomes in a subgroup of 136 patients with type 2 diabetes who underwent RYGB during 2004–07, and had complete data for the four main preoperative predictive factors, to establish the external validity of the DiaRem scoring system.

At 1–2 years after surgery, 71% of the Cleveland Clinic cohort had complete or partial remission of type 2 diabetes, and 49% achieved complete remission. These findings are compatible with Still and colleagues' data (63% complete or partial remission, 49% complete remission). However, at a median of 6 years (range 5–9) after gastric bypass, 58% of the Cleveland Clinic cohort had complete or partial remission, and only 28% complete remission.

We declare that we have no conflicts of interest.

Overall, the original data reported by Still and colleagues agree with data from the long-term Cleveland Clinic cohort, especially data for patients with low DiaRem scores (table). Similar to the original cohort, the proportion of patients achieving long-term diabetes remission in the Cleveland Clinic cohort was greatest for those with the lowest DiaRem scores, and least for those with the highest scores. However, when DiaRem scores are extremely high—ie, in the subgroup of patients who were on insulin at the time of surgery—we did not see strong agreement. This difference might be because the scoring system does not work well when DiaRem scores are extremely high, because a different patient population had been used, or simply because the sample size was insufficient in both the Cleveland Clinic cohort and the cohort used by Still and colleagues.

Predictors of type 2 diabetes remission and recurrence in the Cleveland Clinic cohort were duration of type 2 diabetes and excess weight loss. Based on our analysis, the cutoff point of 5 years or less of diabetes duration was the best timepoint to predict remission (sensitivity 76%, specificity 79%, area under the receiver operating characteristic curve of 0·82). Patients with type 2 diabetes duration of 5 years or less had a 76% long-term remission rate (complete or partial) compared with 21% for patients with duration of type 2 diabetes of greater than 5 years.[3] Data for preoperative duration of diabetes was not available in Still and colleagues' study and was not included in multivariate analyses,[1] which might be a limitation of this scoring system.

Although several weight-independent mechanisms have been proposed, the main mechanism in long-term remission of type 2 diabetes after bariatric surgery is most likely weight loss. Notably, the extent of surgical weight loss was a statistically significant predictive factor for type 2 diabetes remission in several studies, including ours.[2,3] We acknowledge that the model developed by Still and colleagues is based only on preoperative clinical criteria; nevertheless, such a model might not be complete without consideration of the extent of weight loss or regain after surgery.

In conclusion, the DiaRem score seems a valid system for prediction of diabetes remission after RYGB surgery, especially in patients not taking insulin. Other factors such as duration of type 2 diabetes and extent of surgical weight loss are important and should be considered in clinical and research settings.

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Authors' reply

As shown in figure 4 of our Article,[1] the DiaRem score was replicated in two other cohorts: one from Scottsdale, AZ, and a recent cohort of our own patients (Danville, PA) that had not been used in the development of the DiaRem score. The additional replication of the DiaRem score using the Cleveland Clinic cohort is welcome, and further validates the robustness of the DiaRem score.

Preoperative duration of type 2 diabetes was not available for most of our patients and therefore we did not include it in the development of the DiaRem score. Older age before surgery, however, weighted significantly (table 5 in our Article[1]) and might be associated with preoperative duration of type 2 diabetes, which was discussed in our Article.[1] We also add here that duration of type 2 diabetes might not be easy to establish because some patients might be diabetic (or at least prediabetic) before they are diagnosed. As such, it might be difficult to pinpoint the exact time of disease initiation.

Postoperative weight loss could not be included because the DiaRem score is based on preoperative variables. We did, however, find that postoperative weight loss was associated with late type 2 diabetes remission (ie, remission occurring >2 months after RYGB surgery) for patients not using insulin (table 2;[1] hazard ratio [HR] 1·31, p<0·0001), and patients using insulin (table 3;[1] HR 1·16, p<0·0029)—but, being a postoperative measure, it could not be considered for the DiaRem score. Future iterations of the DiaRem score for predicting only late diabetes remission could potentially incorporate postoperative weight loss as a variable, should the weighting system show that it is a significant contributing factor.

We declare that we have no conflicts of interest.

Christopher D Still, G Craig Wood, *George Argyropoulos

gargyropoulos1@geisinger.edu

Institute of Obesity, Geisinger Health System, Danville, PA 17822, USA

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Table

Prediction of diabetes remission according to DiaRem score in Still and colleagues' study compared with the Cleveland Clinic cohort

	Still and colleagues' primary cohort (N=690)[1] ≤2 years after surgery*			Cleveland Clinic cohort (N=136) >5 years after surgery[3]		
	n (%)	Partial or complete remission (% [95% CI])	Complete remission (% [95% CI])	n (%)	Partial or complete remission (%)	Complete remission (%)
0–2	188 (27%)	88% (83–92))	61% (54–68	29 (21%)	86%	55%
3–7	211 (30%)	64% (58–71)	32% (25–38)	50 (37%)	78%	32%
8–12	70 (10%)	23% (13–33)	10% (3–17)	20 (15%)	30%	20%
13–17	167 (24%)	11% (6–16)	5% (2–9)	22 (16%)	27%	5%
18–22	54 (8%)	2% (0–5)	0%	15 (11%)	20%	7%

*In most patients.