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Comparative analysis of practices and outcomes of metabolic and bariatric surgery between Mexico and Latin America: results of a pilot registry

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Abstract

Aim: The interest in metabolic and bariatric surgery (MBS) registries has increased globally. In 2014, a pilot initiative of a multi-institutional collaboration named “LATAM CQI” started in Latin America (LATAM). The aim of the present study is to analyze the results of the 5-year Mexican experience compared to the LATAM data.

Methods: Data were divided into two groups: the Mexican institutions (3,344 patients) and the rest of the hospitals included in the LATAM registry (10,383 patients). Demography, somatometry variables, comorbid conditions, surgical procedures, complications, and outcomes in terms of weight loss and evolution of the comorbid conditions were comparatively analyzed. Descriptive and inferential statistics were applied based on the original scaling of every included variable. Any *P*-value of ≤ 0.05 was considered statistically significant for two-tailed hypothesis testing.

Results: Mean age and mean body mass index (BMI) were very similar between groups. The most common



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comorbid condition was high blood pressure (HBP), followed by Type 2 diabetes (T2D). In Mexico, the most frequently performed surgical procedure was the Roux-en-Y gastric bypass (RYGB) (69%), followed by sleeve gastrectomy (SG) (23.5%). In LATAM, the most common surgical procedure was SG (57.4%). The RYGB was performed in 40.2% of patients. Complications at 30 and 90 days were 6% and 2%, respectively, in Mexico and 4% and 2% in LATAM. The comparative analysis of weight loss divided by surgical procedure was very similar.

Conclusion: Our analysis supports the value of registries as a valuable tool to compare practices and outcomes.

Keywords: Bariatric outcomes, sleeve gastrectomy, Roux-en-Y gastric bypass

INTRODUCTION

Metabolic and bariatric surgery (MBS) is highly effective for patients with severe obesity^[1]. Although there are several guidelines concerning the indications for surgery and the recognized surgical procedures, both the indications and the usage of the different surgical procedures have significant variations worldwide^[2-4].

The interest in medical registries has increased globally. Registries have helped to know differences in patient characteristics from different populations and differences in practices among bariatric centers, and they have been important tools to ensure and improve the quality of MBS^[5,6]. Some registries not only include the clinical outcomes but also process indicators and even patient-reported outcomes. Registries can be based on hospitals; medical associations and some countries even have national registries^[7,8].

The culture of reporting in Latin America (LATAM) is in its infancy. A few surgeons and hospitals have developed databases, and most registries are based on individual efforts. In 2014, a pilot initiative of a multi-institutional collaboration named “LATAM quality community-centers of bariatric and metabolic surgery clinical quality indicators (CQI)” started in LATAM. Based on the input of an ad hoc committee of interested bariatric surgeons, a prospective database was constructed. The pioneer country was Colombia, and bariatric centers from Argentina, Brazil, Chile, and Mexico were incorporated in 2017.

As a proof of concept, the five participating Mexican institutions also imported into the registry the retrospective data of patients who underwent surgery in 2015 and 2016 obtained from the existing hospital databases. Once the adequacy of the tool was confirmed, the prospective collection started.

The aim of the present study is to analyze the results of the 5-year Mexican experience included in the LATAM CQI compared to the LATAM data up to June 2020.

METHODS

Data from the LATAM CQI database were divided into two groups. In one group, the Mexican institutions were merged and in the other group, the rest of the hospitals included in the LATAM registry were grouped together. Among the characteristics of the registry, reporting was not compulsory; the custodian was Econometria SA; each group had a leader in charge of data reports; there was a data dictionary, patients were deidentified, and each center established an outlier policy. A repository with the data supporting the results of this article has been sent to editors, with the respective confidentiality and anonymity measures for the protection of the identity of the patients.

Demography, somatometry variables, comorbid conditions, surgical procedures, complications, and outcomes in terms of weight loss and evolution of the comorbid conditions were comparatively analyzed.

Operational definitions:

Diabetes mellitus: Defined as type 2 diabetes (T2D) on oral medication or insulin therapy.

High blood pressure (HBP): Confirmed clinical hypertension on medication.

Depression: Clinical depression on medication as an indication for MBS.

Sleep apnea: Confirmed sleep apnea with the usage of continuous positive airway pressure (CPAP).

Dyslipidemia: Confirmed dyslipidemia on medication.

GERD: Defined as gastro-esophageal reflux disease on medication.

Statistical analysis was performed using IBM SPSS Statistics v 26 and Microsoft Excel for iMac v 16.46. Descriptive and inferential statistics were applied based on the original scaling of every included variable. Nominal or categorical comparisons were made with Chi-square and Fisher's exact tests, Kendall's tau-b, Gamma, Spearman correlation, and Pearson's for ordinal and two-way analysis of variance (ANOVA) for repeated (time series), and continuous measures of multiple independent groups (LATAM *vs.* Mexico) were contrasted based on the type of MBS [Roux-en-Y gastric bypass (RYGB) and sleeve gastrectomy (SG)]. Any *P*-value of ≤ 0.05 (or 5% for the type I error) was considered as statistically significant for two-tailed hypothesis testing.

Ethics statement:

The data reported in the manuscript were collected from retrospective blinded databases and reported in counts and percentages such that participants are not able to be identified from the results. The protocol was approved by the Institutional Review Board (IRB).

RESULTS

In Mexico, a total of 13 surgeons working in five institutions participated in the registry. The rest of LATAM included 30 surgeons working in ten institutions.

In the five years of data collection, the 3,344 patients included in the Mexican registry were contrasted with the 10,384 corresponding to the other LATAM institutions. In Mexico, there were 2,522 females (75%) and 822 males (25%), and in LATAM, the percentage of females *vs.* males was 73% and 27%, respectively. The mean age of patients in Mexico and LATAM was very similar, 39 and 41 years, respectively. The mean body mass index (BMI) was 43.4 ± 7.9 kg/m² in Mexico and 40.1 ± 6.57 kg/m² in LATAM. Patient distribution by the degree of obesity and gender is shown in [Figure 1](#). The obesity degree in males and females was statistically different in both Mexico and LATAM (Kendall's tau = 0.14, *P* < 0.0001). In Mexico, there was an increasing trend of the obesity degree in both genders, higher in males (Spearman correlation = 0.15, *P* < 0.0001) and in LATAM, the trend was decreasing with a lesser association (Spearman correlation = 0.09, *P* < 0.0001).

In Mexico, the most frequently performed surgical procedure was the RYGB followed by SG, whereas in LATAM, the most common surgical procedure was SG followed by RYGB. [Figure 2](#) shows the distribution of surgical procedures in both groups. From the total number of surgical procedures, 91% were primary and 9% revisional in Mexico, whereas percentages of primary and revisional procedures in LATAM were 89.4% and 10.6%.

In Mexico, surgical morbidity occurred in 6% of the patients at 30 days and 2% of patients had an additional complication at 90 days. Complications at 30 and 90 days in LATAM were 4% and 2%. There was one surgical mortality in Mexico. The most common surgical complications are shown in [Table 1](#).

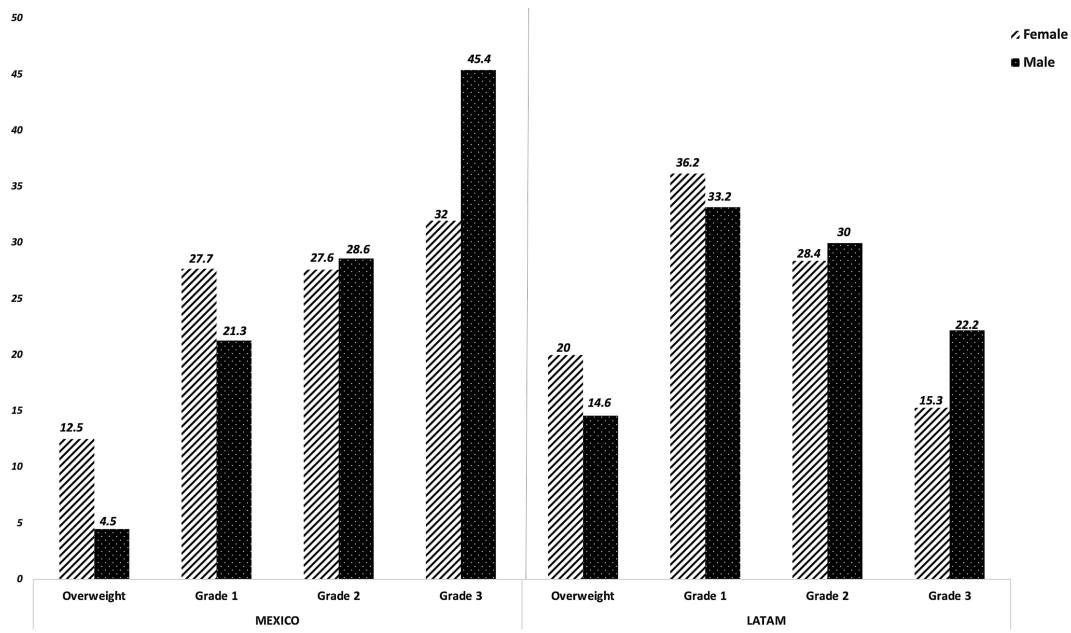


Figure 1. Degrees of Obesity by gender comparing patients from LATAM vs. Mexico. Differences in the obesity degree between males and females (Kendall's tau = 0.14, $P < 0.0001$). Increasing trend of the obesity degree in Mexico (Spearman correlation = 0.15, $P < 0.0001$). Decreasing trend of the obesity degree in LATAM (Spearman correlation = 0.09, $P < 0.0001$). LATAM: Latin America.

TYPES OF BARIATRIC SURGERY

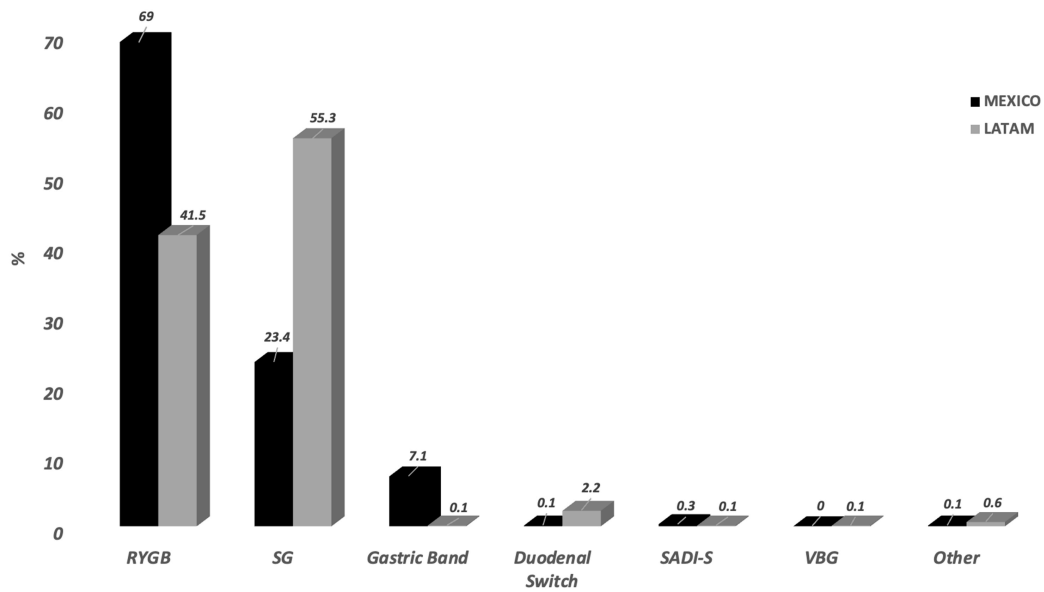


Figure 2. Case frequency regarding the different types of MBS occurring in Mexico and LATAM registry cohorts. It includes primary and revisional procedures. Chi-square test for all proportions together with a $P < 0.0001$. It may be noted that the main differential proportions are between RYGB and SG regarding Mexico with LATAM. MBS: Metabolic and bariatric surgery; LATAM: Latin America; RYGB: Roux-en-Y gastric bypass; SG: sleeve gastrectomy.

The comparative analysis of weight loss expressed as excess weight loss (EWL) and change in the BMI was performed in two groups according to the most frequently performed surgical procedures, and it is shown

Table 1. Reported surgical complications between LATAM and Mexico according to the two most common MBS procedures

	RYGB			SG		
	Mexico (n = 1,554)	LATAM (n = 1,828)	P	Mexico (n = 514)	LATAM (n = 2,419)	P
30 days						
Leaks, %	1.6	0.6	0.003**	0.6	0.3	0.30
Bowel obstruction, %	0.4	0.4	0.96	0.0	0.04	0.83
DVT, %	0.1	0.1	0.59	0.0	0.1	0.54
PE, %	0.1	0.1	0.98	0.0	0.1	0.54
90 days						
Leaks, %	0.0	0.1	0.34	0.0	0.1	0.62
DVT, %	0.0	0.1	0.58	0.3	0.1	0.49
PE, %	-	-	-	0.0	0.04	0.85
Death, %	0.1	0.0	0.42	0.0	0.04	0.85

Statistically significant values using the Fisher exact test are highlighted with asterisks (**) after Bonferroni adjustment for multiple comparisons. No statistical significance was found using the chi-square test. LATAM: Latin America; MBS: metabolic and bariatric surgery; RYGB: Roux-en-Y gastric bypass; SG: sleeve gastrectomy; DVT: deep venous thrombosis; PE: pulmonary embolism.

in Figure 3. The most common comorbid condition was HBP, followed by T2D. Figure 4 shows the evolution of T2D, HBP, and dyslipidemia in the total group included in the database divided by the two most common surgical procedures (RYGB and SG).

DISCUSSION

The current analysis of 13,727 patients who underwent bariatric/metabolic surgery in five countries of LATAM during five years has allowed the identification of some similarities and differences in the practice of MBS between Mexico and the other analyzed countries. For practicality, we will divide the discussion into three different areas. The first important area for analysis relates to patient characteristics. Our data show that age and gender distributions at the time of surgery were very similar in Mexican patients and those from other LATAM countries. However, BMI was higher in comorbid conditions such as sleep apnea and dyslipidemia were present in a higher number of Mexican patients, whereas GERD was more frequently identified in LATAM.

Concerning the presence of comorbidities before surgery, the incidence of T2D was similar in Mexico to that in LATAM, whereas HBP and dyslipidemia had a different prevalence. In the absence of a standard algorithm for the evaluation of comorbid conditions, differences may be real or related to the clinical accuracy and diagnostic methodology of each center. Differences in the prevalence of comorbidities may also be related to ethnicity. In the USA, for example, the frequency of T2D is higher in American Indians/Alaska Natives (14.7%), people of Hispanic origin (12.5%), and non-Hispanic blacks (11.7%) than in Caucasians^[9-11]. This suggests that obesity is strongly influenced by factors such as gender, age, ethnic group, geographic area, and socioeconomic stratum. Differences in the prevalence of T2D have been noted even in people with similar ethnic ancestry but from different countries, and in the same way, some authors have suggested that the genetic/ethnic background may have a significant impact on weight loss and metabolic improvement even when using the same surgical technique in patients with the same ancestry^[12].

The second area corresponds to the surgical practice. The distribution of surgical procedures was different in Mexico than in LATAM. RYGB was performed in 69% of the Mexican patients and 40.2% of patients from LATAM. This higher frequency of RYGB in the Mexican group may be related to a higher BMI at the time of surgery, compared to the LATAM group, since in the Mexican group, 63% of the patients were

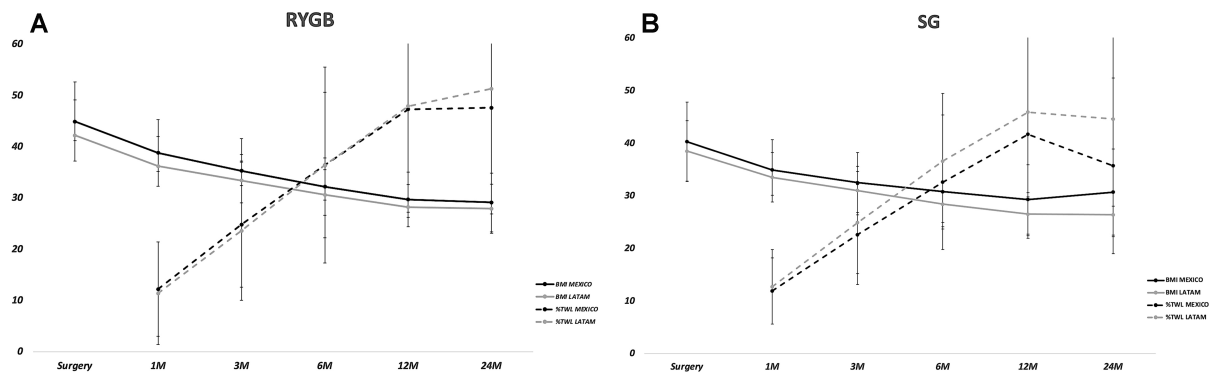


Figure 3. Time series trend for the BMI and %TWL based on the type of MBS between LATAM and Mexico. (A) Markers represent Means \pm SD. ANOVA test comparing multiple means resulted in a $P < 0.01$ for this time series; (B) Markers represent Means \pm SD. ANOVA test comparing multiple means resulted in a $P < 0.004$ for this time series. BMI: Body mass index; %TWL: percentage of total weight loss; MBS: metabolic and bariatric surgery; LATAM: Latin America; SD: standard deviation; ANOVA: analysis of variance.

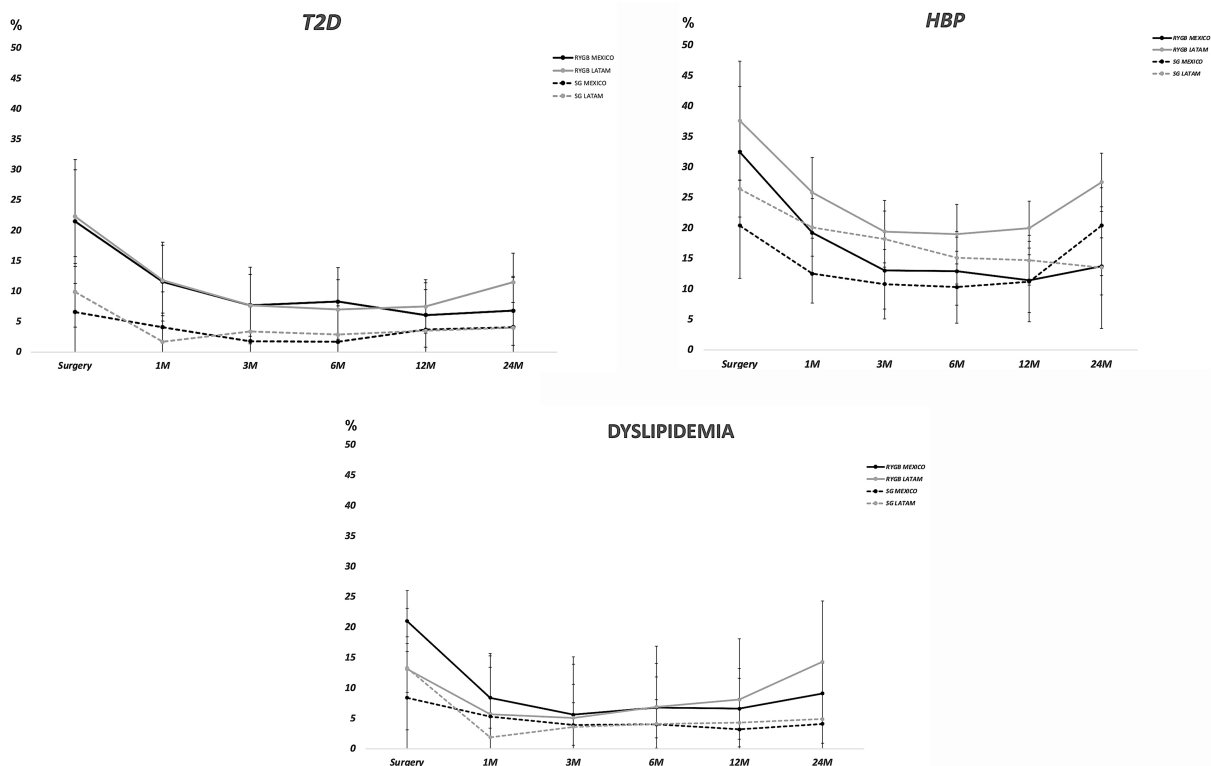


Figure 4. Time series trend for the three most common comorbidities (T2D, HBP, and Dyslipidemia) according to the type of MBS comparing LATAM with Mexico. Markers represent means \pm SD. T2D: Type 2 diabetes; HBP: high blood pressure; MBS: metabolic and bariatric surgery; LATAM: Latin America; SD: standard deviation.

operated on with a morbid or super obesity status, while in the LATAM group, 54% of the patients were operated on with a BMI < 40 kg/m². SG predominated in LATAM countries showing a close similarity to the latest estimations of the usage of the different surgical procedures in the USA^[13]. Although the selection of surgical procedures may be related to multiple factors, in most cases the surgeon’s preference plays the most important role. This preference is based not only on the choice of procedure, but also on the technical variations of each surgery; there is evidence that technical differences may have an impact on the results^[14].

It was interesting to see that revisional surgery in LATAM doubled the Mexican figure.

Finally, the analysis of outcomes is the most important. Data from registries in other countries have served to develop composite measures of quality and improve safety culture in hospitals, improve patient care and reduce mortality^[15]. An example is the Michigan Bariatric Surgery Collaborative, which developed innovative outcome reports in MBS that led to the establishment of accreditation standards for bariatric centers. Today, their procedures are considered global benchmarks of surgical quality^[16,17]. In terms of surgical morbidity, leaks were twice as frequent in Mexico than in LATAM. In a multi-institutional analysis of 40,983 patients who underwent RYGB published in 2018^[18], the leak rate was 1.2%. Preoperative history of oxygen dependency, hypoalbuminemia, sleep apnea, hypertension, and diabetes mellitus were factors predictive of gastrointestinal leak. Additionally, the use of intraoperative provocative testing and placement of a surgical drain were associated with a higher leak rate. In the absence of information on patient characteristics, it is difficult to make an appropriate judgment of our increased leak rate. Surgeons from the participating institutions have been notified of the results and will review their institutional results.

Despite differences in the selection of surgical procedures, weight loss and resolution of comorbid conditions were very similar in both series. In order to further assess potential differences in the resolution of comorbid conditions between SG and RYGB, the total series was analyzed as a group. It was noticed that T2D, arterial hypertension, and dyslipidemia were significantly more frequent in the group of patients undergoing bypass. This may reflect the perception among surgeons that RYGB is more efficient in the control of these comorbid conditions. However, several studies have shown that weight loss and resolution of comorbid conditions are very similar in patients undergoing SG and RYGB, and this may be reflected in global trends and preferences. SG is the most frequently performed surgical procedure in both the USA and LATAM^[13,19]. Surprisingly, this trend is not observed in the data for Mexico, perhaps because of the participating institutions.

In addition to the analysis included in our study, we think that it is highly important to obtain reliable data from LATAM countries as quality control, for benchmarking, education, and to encourage coverage by insurance companies^[15].

The study has several limitations. One is the number of patients with incomplete follow-up, which is a known problem in MBS. Another is the limited number of institutions included in each country. We realize that in Bariatric patients, it is very important to have long-term results. However, we believe that a medium-term analysis is very important to address potential problems that may require prompt attention.

In conclusion, our analysis supports the value of registries as a valuable tool for comparing practices and outcomes. Relevant findings include: similar demographics between both groups, a preference for RYGB in Mexico, similar 30- and 60-day surgical morbidity between groups, and despite differences in the selection of surgical procedures, weight loss and resolution of comorbid conditions appear very similar in both groups.

DECLARATIONS

Authors' contributions

Inclusion of patients in the database and manuscript preparation: Sánchez HA

Data analysis and manuscript review: Velázquez-Fernández D

Inclusion of patients in the database and review of results: Zerrweck C, Campos F, Zapata M, Guilbert L, Pantoja JP, Sierra M, González I, Romero G

Study design, data and manuscript review: Herrera MF

Availability of data and materials

The database of the study is available from the corresponding author upon reasonable request.

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Conflicts of interest

All authors declared that there are no conflicts of interest.

Ethical approval and consent to participate

The protocol was approved by the ABC Medical Center Institutional Review Board, with approval No: ABC-17-11. Besides, the consent to participate was obtained from every patient.

Consent for publication

Not applicable.

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