SURGERY FOR OBESITY AND RELATED DISEASES

Surgery for Obesity and Related Diseases ■ (2023) 1–7

Original article

Making lemonade with lemons: a multicenter effort to improve outpatient sleeve gastrectomy amid the COVID-19 pandemic

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Received 13 July 2022; accepted 21 January 2023

Abstract

Background: The COVID-19 pandemic impacted healthcare delivery worldwide. Resource limitations prompted a multicenter quality initiative to enhance outpatient sleeve gastrectomy workflow and reduce the inpatient hospital burden.

Objectives: This study aimed to determine the efficacy of this initiative, as well as the safety of outpatient sleeve gastrectomy and potential risk factors for inpatient admission.

Setting: A retrospective analysis of sleeve gastrectomy patients was conducted from February 2020 to August 2021.

Methods: Inclusion criteria were adult patients discharged on postoperative day 0, 1, or 2. Exclusion criteria were body mass index $\geq$60 kg/m^2 and age $\geq$65 years. Patients were divided into outpatient and inpatient cohorts. Demographic, operative, and postoperative variables were compared, as well as monthly trends in outpatient versus inpatient admission. Potential risk factors for inpatient admission were assessed, as well as early Clavien-Dindo complications.

Results: Analysis included 638 sleeve gastrectomy surgeries (427 outpatient, 211 inpatient). Significant differences between cohorts were age, co-morbidities, surgery date, facility, operative duration, and 30-day emergency department (ED) readmission. Monthly frequency of outpatient sleeve gastrectomy rose as high as 71% regionally. An increased number of 30-day ED readmissions was found for the inpatient cohort (P = .022). Potential risk factors for inpatient admission included age, diabetes, hypertension, obstructive sleep apnea, pre–COVID-19 surgery date, and operative duration.

Conclusion: Outpatient sleeve gastrectomy is safe and efficacious. Administrative support for extended postanesthesia care unit recovery was critical to successful protocol implementation for outpatient sleeve gastrectomy within this large multicenter healthcare system, demonstrating potential applicability nationwide. (Surg Obes Relat Dis 2023;■:1–7.) © 2023 American Society for Metabolic and Bariatric Surgery. Published by Elsevier Inc. All rights reserved.

Keywords: Same-day surgery; Ambulatory surgery; Outpatient surgery; Sleeve gastrectomy; COVID-19 pandemic

This work was presented as an oral poster presentation at the 38th annual American Society for Metabolic and Bariatric Surgery meeting on June 7, 2022.

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https://doi.org/10.1016/j.soard.2023.01.022

Laparoscopic sleeve gastrectomy (LSG) is the most frequently performed bariatric surgery in the United States (US) with over 150,000 cases in 2018 alone [1–3]. Recent analysis of the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) found outpatient sleeve gastrectomy to have no association with increased mortality nor risk of reoperation, leakage, or bleeding compared with patients admitted to inpatient units [4]. The benefits of outpatient surgery include cost savings and improved patient satisfaction [5].

Despite the safety and benefits, outpatient surgery for LSG remains uncommon and occurs in approximately 3% of US LSGs [4]. However, the COVID-19 pandemic dramatically altered the healthcare landscape. The pandemic strained hospital resources, and in following the recommendations of the US Surgeon General, White House Coronavirus Task Force, and Centers for Medicare and Medicaid services many hospitals across the US postponed elective surgeries to maintain hospital vacancy. Further, institutional and patient driven fears of nosocomial COVID-19 infection led many hospital systems to encourage earlier discharge for surgical patients with enhanced pre- and postoperative teaching, as well as home monitoring [6,7]. These concerns resulted in a multicenter quality initiative to strengthen outpatient sleeve gastrectomy workflow. This study aimed to determine the efficacy of this initiative, as well as the safety of outpatient LSG and potential risk factors for inpatient admission.

Methods

A multicenter retrospective analysis of patients undergoing LSG was conducted within a large healthcare system. Five distinct hospitals were included with data analysis spanning February 3, 2020, through August 31, 2021. The analysis involved 16 surgeons. Each surgeon operated at a single hospital. A bariatric surgery fellow assisted at Hospital 1. Trainees were not involved in surgical care at Hospitals 2 through 5. Technique was not standardized between surgeons nor modified for the purpose of this study. Data were extracted by chart review after institutional review board approval.

Inclusion and exclusion criteria

The study cohort was made up of adult patients (aged ≥18 yr) who underwent LSG. Patients were included in analysis after implementation of the outpatient sleeve gastrectomy protocol at each individual hospital. Patients with body mass index (BMI) <60 kg/m^2 and younger than 65 years were counseled preoperatively on the expectation of outpatient surgery. Patients with BMI ≥60 kg/m^2 and aged 65 or older were deemed high risk and not offered outpatient LSG. These patients were excluded from analysis. Patients discharged on postoperative day 0, 1, or 2 were included. Hospital stays of 3 days or longer were excluded from analysis to reduce confounding bias for the inpatient cohort. Patients were divided into outpatient and inpatient cohorts. Outpatient LSG was defined as discharge on postoperative day 0 versus postoperative day 1 or 2 for the inpatient cohort.

Variables and outcomes

Variables obtained include demographic (age, sex, BMI, co-morbidities) and operative data (surgery date, facility, procedure, operative duration, length of stay). Procedures were designated as sleeve or sleeve + combination procedure. Combination procedures encompassed cholecystectomy, diaphragmatic hernia repair, epigastric hernia repair, gastric band removal, incisional hernia repair, liver biopsy or resection, lysis of adhesions, paraesophageal hernia repair, salpingectomy, umbilical hernia repair, and ventral hernia repair.

Postoperative outcome data involved emergency department (ED) or hospital readmission, reoperation, mortality, excess weight loss, and change in BMI. ED readmissions were defined as a 23-hour or less observation in the ED without admission to a hospital floor. The main outcome was monthly frequency of outpatient LSG. Secondary outcomes were postoperative readmissions, reoperations, and mortality, as well as potential risk factors for inpatient admission.

Outpatient sleeve gastrectomy protocol

In February 2020, a single facility (Hospital 1) within the authors' multicenter healthcare system developed and initiated an outpatient sleeve gastrectomy protocol. Patients with BMI <60 kg/m^2 and age younger than 65 years were included. In accordance with standard preoperative bariatric surgery recommendations, each patient attended an orientation course, nutrition class, and support group, as well as consultation with dieticians, psychologists, and a bariatric surgeon. Additional preoperative imaging and pulmonary or cardiac assessments were performed on a case-by-case basis. Preoperative weight loss of 5% to 10% of the patient's starting weight was mandated as part of the regional healthcare system policy for all bariatric surgery patients. Each patient attended a preoperative class that consisted of education on the anticipated perioperative course including the expectation of outpatient surgery. Baseline preoperative laboratory values were obtained.

Perioperative care included an enhanced recovery after surgery (ERAS) protocol that involved carbohydrate loading, minimization of intraoperative fluids, multimodal pain control with limited narcotics, and emphasis on postoperative nausea prevention. Regional anesthesia was not routinely used. Patients with operations February 3, 2020, through March 13, 2020, were monitored in the postanesthesia care unit (PACU) before transfer to the surgical floor. A postoperative hemoglobin level was obtained 2 hours after surgery.

Guidelines for discharge home required vital sign stability with heart rate less than 100 and systolic blood pressure greater than 90, postoperative pain and nausea control, toleration of 5 ounces of fluids with 3 ounces in a single hour, ability to void and ambulate independently, as well as postoperative hemoglobin with less than a 1.5 g/dL decrease from the patient's preoperative baseline value. If patients did not achieve the discharge criteria, they were admitted to the surgical floor for overnight observation. These patients were changed to the inpatient arm for statistical analysis. Discharge criteria remained unchanged and included vital sign stability, postoperative pain and nausea control, toleration of 5 ounces of fluids with 3 ounces in a single hour, ability to void and ambulate, as well as postoperative hemoglobin with less than a 1.5 g/dL decrease from the patient's preoperative baseline value. If hemoglobin decreased by 1.5 g/dL or more from the preoperative baseline value, serial hemoglobin levels were obtained until the value was stable.

Postoperative follow-up involved a telephone call on postoperative day 1 that assessed pain and nausea control, fluid intake (type and volume), voiding, ambulation, and heart rate. Many patients utilized blood pressure monitors or smart watches for heart rate monitoring. Those without this technology were taught how to identify their pulse to measure their heart rate. Routine follow-up occurred at 2 and 4 weeks, as well as 3 and 6 months.

Due to the COVID-19 pandemic, all elective surgeries were canceled beginning March 14, 2020, and reinstated in June of 2020. To minimize the burden on hospital resources, as well as nosocomial infection risk, the outpatient sleeve gastrectomy protocol was modified to no longer include admission to the surgical floor. Patients who met the outpatient criteria were monitored in the PACU for approximately 3 to 5 hours postoperatively then discharged home. A preoperative COVID-19 test was added to the laboratory workup.

Protocol expansion

To ensure uniform protocol rollout, regional video conference meetings were held to discuss multicenter implementation. Preliminary safety data were assessed and confirmed. The outpatient sleeve gastrectomy protocol was trialed at Hospital 2 in December 2020 before regional implementation at 3 additional facilities (Hospitals 3–5) in March 2021.

Statistical analysis

Analysis was performed using Statistical Package for the Social Sciences (SPSS) for Windows, version 25 (IBM Corp., Armonk, NY, USA). The χ^2 or Fisher exact test for large or small sample sizes were used for categorical variables. The Student t test and Mann-Whitney U test were used for parametric and nonparametric continuous variables, respectively.

Hypothesis tests were 2-sided, and a P value $<.05$ was considered statistically significant. A univariable analysis assessed potential risk factors for inpatient admission. An odds ratio with 95% confidence intervals was reported.

Results

Analysis included 638 LSG (427 outpatient, 211 inpatient). Several statistically significant differences in preoperative and operative data were identified, including age ($P = .001$); BMI ($P = .002$); prevalence of diabetes ($P = .045$), hypertension ($P = .019$), and obstructive sleep apnea ($P < .001$); surgery date ($P < .001$); facility ($P < .001$); and operative duration ($P = .033$). Length of stay (LOS) was inherently different ($P < .001$). The average LOS for the outpatient cohort, from hospital arrival to discharge, was 7 hours (Table 1).

There was no statistical difference in rates of 7-day ED readmission, hospital readmission, reoperation, or 30-day mortality. Outpatient surgeries had higher rates of 7-day ED readmission (9% versus 8%, $P = .641$) though this was not statistically significant. An increased rate of 30-day ED readmission (13% versus 20%) was found for patients that were changed to the inpatient arm ($P = .022$) (Table 1).

A univariable analysis was performed to assess potential risk factors for inpatient admission and can be found in Table 2. Significant findings include older age, diabetes, hypertension, obstructive sleep apnea, pre–COVID-19 surgery date, and longer operative duration ($P < .05$). Surgery date and obstructive sleep apnea had the highest odds ratio at 10.3 and 2.8, respectively.

Tables 3 and 4 list the Clavien-Dindo complications for 7-day ED and 30-day hospital readmission. Early (7-d ED) complications with the highest frequency include nausea/vomiting/dehydration and abdominal pain/constipation. Clavien-Dindo grade III complications within 30 days of the index operation included 1 non–bariatric-related surgery (cervical spine fusion). There were no Clavien-Dindo grade IV or V complications. Clavien-Dindo grade III, IV, and V complications indicate a need for intervention, intensive care unit management, or mortality.

Monthly frequency of outpatient sleeve gastrectomy at Hospital 1 rose from 13% in February 2020 to 96% in November 2020. After all 5 hospitals had initiated the protocol, the monthly frequency of outpatient sleeve gastrectomy increased as high as 71%. The number of monthly LSG varied with reduced volumes corresponding to the US COVID-19 pandemic surges (Fig. 1).

Table 1
Comparison of demographic, operative, and postoperative variables

Variable	Outpatient (n = 427)	Inpatient (n = 211)	*P* value
Demographic data			
Age (yr), mean ± SD	40 ± 10	43 ± 10	.001
Sex, n (%)			.146
Female	367 (86%)	172 (82%)	
Male	6 (14%)	39 (18%)	
BMI, mean ± SD	42 ± 5	42 ± 6	.002
Co-morbidities, n (%)			
Diabetes	47 (16%)	37 (23%)	.045
Hypertension	106 (35%)	74 (46%)	.019
Obstructive sleep apnea	108 (36%)	97 (60%)	<.001
Operative data			
Surgery date, n (%)			
Pre–COVID-19 (before March 14, 2020)	7 (2%)	31 (15%)	<.001
Post–COVID-19	420 (98%)	180 (85%)	
Facility (protocol implementation)			
Hospital 1 (February 3, 2020)	218 (51%)	60 (28%)	<.001
Hospital 2 (December 1, 2020)	102 (24%)	18 (9%)	
Hospital 3 (March 4, 2021)	22 (5%)	55 (26%)	
Hospital 4 (March 22, 2021)	49 (12%)	20 (10%)	
Hospital 5 (March 31, 2021)	36 (8%)	58 (28%)	
Procedure, n (%)			
Sleeve	370 (87%)	179 (85%)	.533
Sleeve + combination procedure	57 (13%)	32 (15%)	
Operative duration (min), mean ± SD	41 ± 12	39 ± 14	.033
LOS (hr), mean ± SD	7 ± 2	28 ± 8	<.001
Postoperative data			
Readmission to emergency department			
7-d	37 (9%)	16 (8%)	.641
30-d	57 (13%)	43 (20%)	.022
Readmission to hospital			
7-d	3 (1%)	3 (1%)	.376
30-d	6 (1%)	7 (3%)	.108
Reoperation (bariatric-related)			
7-d	0 (0%)	0 (0%)	N/A
30-d	0 (0%)	0 (0%)	N/A
Mortality within 30 d	0 (0%)	0 (0%)	N/A
EWL (6-mo), mean ± SD	69% ± 19%	67% ± 20%	.636
Change in BMI (6-mo), mean ± SD	10 ± 3	9 ± 3	.790

SD = standard deviation; BMI = body mass index; LOS = length of stay; N/A = not applicable; EWL = excess weight loss.

Discussion

The COVID-19 pandemic altered the healthcare landscape. It introduced fears regarding nosocomial infection in postoperative patients in tandem with healthcare resource obstacles [8]. To alleviate hospital resources, elective surgeries across the US were postponed maintaining hospital vacancy [6,8,9]. Cessation of elective surgery compounded financial stress felt by healthcare systems as elective surgery is a major source of revenue for hospitals [10]. This crossroads of public safety and financial pressure led to a growing interest in outpatient surgery by many surgical specialties and hospital administrators [8,11].

Outpatient sleeve gastrectomy has been described in the literature for nearly a decade. Most studies tout the short-term safety of outpatient sleeve gastrectomy with appropriate patient selection and postoperative protocols [12–18]. Yet, despite the known cost effectiveness, feasibility, and safety, few surgeons have adopted the practice [4]. For the authors' healthcare system, the COVID-19 pandemic was the nidus needed to fully investigate and adopt outpatient sleeve gastrectomy to provide timely access to care.

In this study, improved efficacy for the outpatient sleeve gastrectomy protocol was found with direct discharge from the PACU rather than the surgical floor. The etiology of this is likely multifactorial. PACU nurses may be more comfortable with reassuring and educating patients on early discharge after surgery. There may also be a psychological component where admission to a quiet room on a surgical floor could make patients apathetic to outpatient surgery.

Table 2
Potential risk factors for inpatient admission

Variable	Univariable analysis		
	P value	OR	95% CI
Demographics			
45+ yr of age	.004	1.6	1.2–2.3
Female sex	.146	.7	.5–1.1
Co-morbidities			
BMI 55+	.060	2.9	.9–9.2
Diabetes	.045	1.6	1.0–2.6
Hypertension	.019	1.6	1.1–2.3
Obstructive sleep apnea	<.001	2.8	1.9–4.1
Operative			
Pre–COVID-19 surgery date	<.001	10.3	4.5–23.9
Combination case (sleeve + other)	.518	1.2	.7–1.9
Operative duration (40+ min)	.015	1.5	1.1–2.1
Postoperative			
EWL <60% at 6 mo	.333	.6	.2–1.6
Readmission to ED (7 d)	.641	.9	.5–1.6
Readmission to ED (30 d)	.022	1.7	1.1–2.6
Hospital admission (7 d)	.376	2.0	.4–10.2
Hospital admission (30 d)	.108	2.4	.8–7.3
Reoperation (7 d)	N/A	N/A	N/A
Reoperation (30 d)	N/A	N/A	N/A
Mortality (30 d)	N/A	N/A	N/A

OR = odds ratio; CI = confidence interval; BMI = body mass index; EWL = excess weight loss; ED = emergency department; N/A = not applicable.

Finally, the fear associated with the COVID-19 pandemic may have motivated patients to be more willing to opt for outpatient surgery [8,10,19]. It should be noted, in this study, the average LOS for outpatient sleeve gastrectomy patients was 7 ± 2 hours. This corelates to an approximately 4-hour PACU stay. Four hours is an increased duration as compared with other traditional outpatient surgeries such as the laparoscopic cholecystectomy or inguinal hernia repair. Administrative discussions and support were needed to allow for the increased staffing requirements.

One notable difference between this study and other previously published outpatient sleeve gastrectomy studies is patient selection. In general, previous studies mandate strict exclusion criteria for outpatient sleeve gastrectomy to minimize potential risk. Various exclusions consist of age, weight/BMI, operative duration, mobility status, co-morbidities, American Society of Anesthesiologists class, and revisions [12,13,15,16]. The authors maintained minimal exclusion criteria for outpatient sleeve gastrectomy allowing higher emphasis on individual patient reserve and motivation. Patients that crossed from the outpatient to inpatient arm were more commonly older, had co-morbidities such as diabetes, hypertension, and obstructive sleep apnea, and had longer operative times. This conversion from outpatient to inpatient arm was not seen as a failure but rather a success as postoperative outcomes were equivalent between the cohorts. This indicates that postoperative patient and surgeon judgment regarding need for admission is a reliable indicator to ensure patient safety.

From a safety perspective, there was no difference in 7-day ED readmission, hospital readmission, reoperation, or 30-day mortality. It is notable though that inpatient sleeve gastrectomy had higher rates of 30-day ED readmission (20% versus 13%, *P* = .022) though these ED presentations did not necessarily result in hospital admission. This may represent a self-selection bias for the inpatient cohort in that these patients may be more apt to seek ED or hospital care over those patients more comfortable with outpatient surgery.

Table 3
Emergency department 7-day readmissions

Clavien-Dindo classification	Type of complication	Outpatient (n = 37/427)	Inpatient (n = 17/211)
Grade I	Abdominal pain/constipation	9 (2.1%)	3 (1.4%)
	Arrhythmia/irregular BP	2 (0.5%)	1 (0.5%)
	Blurred vision	1 (0.2%)	1 (0.5%)
	Chest pain	3 (0.7%)	1 (0.5%)
	Dermatitis/wound concerns	3 (0.7%)	
	Dysphagia		1 (0.5%)
	Dyspnea/respiratory distress	3 (0.7%)	
	Extremity discomfort		2 (0.9%)
	Fever	1 (0.2%)	
	Hematuria	1 (0.2%)	
	Intra-abdominal bleed without transfusion	1 (0.2%)	1 (0.5%)
	Nausea/emesis/dehydration	11 (2.6%)	5 (2.4%)
	Paresthesias		2 (0.5%)
Grade II	Diabetic ketoacidosis (no ICU)	1 (0.2%)	
	Mesenteric/portal vein thrombosis	1 (0.2%)	
Grade IIIa		None	None
Grade IIIb		None	None
Grade IV		None	None
Grade V		None	None

BP = blood pressure; ICU = intensive care unit.

Table 4
Hospital 30-day readmissions

Clavien-Dindo classification	Type of complication	Outpatient (n = 6/427)	Inpatient (n = 6/211)
Grade I	Dysphagia		1 (.5%)
	Dyspnea	1 (.2%)	
	Intra-abdominal bleed without transfusion	1 (.2%)	
	Nausea/emesis/dehydration		4 (1.9%)
Grade II	Diabetic ketoacidosis (no ICU)	1 (.2%)	
	Intra-abdominal bleed with transfusion		
	Mesenteric/portal vein thrombosis	1 (.2%)	1 (.5%)
	Surgical-site infection	1 (.2%)	
Grade IIIa			
Grade IIIb	Unrelated surgery (cervical spine fusion)	1 (.2%)	
Grade IV		None	None
Grade V		None	None

ICU = intensive care unit.

The authors hope that this study will obviate concerns regarding hydration status when the overnight stay is eliminated. Within the outpatient cohort, 2.6% of patients returned to the ED due to nausea, vomiting, or dehydration, as compared with 2.4% for the inpatient cohort. Similarly, 2.1% of outpatients presented with abdominal pain or constipation, as compared with 1.4% of inpatients. A higher-powered study is needed to determine if these differences are statistically significant.

If future studies demonstrate a statistically higher incidence, many of the Clavien-Dindo grade I complications present an opportunity for prevention. While the complications in this study are consistent with the current literature [20–22], considerations include modifications to intraoperative fluid volumes, outpatient fluid infusion, improved education on pain control, as well as a routine bowel regimen. Recommendations regarding intra operative fluid administration for bariatric surgery patients are largely based on colorectal surgery data. Future studies delineating restrictive versus liberal fluid administration may benefit outpatient sleeve gastrectomy to reduce readmission due to dehydration. Further, abdominal pain/constipation was the second most common early ED readmission. Neither inpatient nor outpatient sleeve gastrectomy patients were discharged with a narcotic prescription or a routine bowel regimen. Despite the lack of narcotic usage, reduced fluid intake often exacerbates constipation. Institution of a bowel regimen is one modality that may reduce ED readmission.

This study is the first regional, multicenter analysis on outpatient sleeve gastrectomy within a single healthcare system. Nonetheless, it is not without limitations. The generalizability of our data may be limited or not applicable to other countries or even regions within the US given variable patient populations. Selection bias is inherent to the nature of this study, as high-risk patients were excluded from outpatient surgery and higher risk patients may have been subjectively admitted overnight increasing the propensity for unmatched cohorts. Additionally, follow-up data for this study were limited to 30-day ED and hospital readmission, reoperations, and mortality. While the short-term safety of outpatient sleeve gastrectomy has been

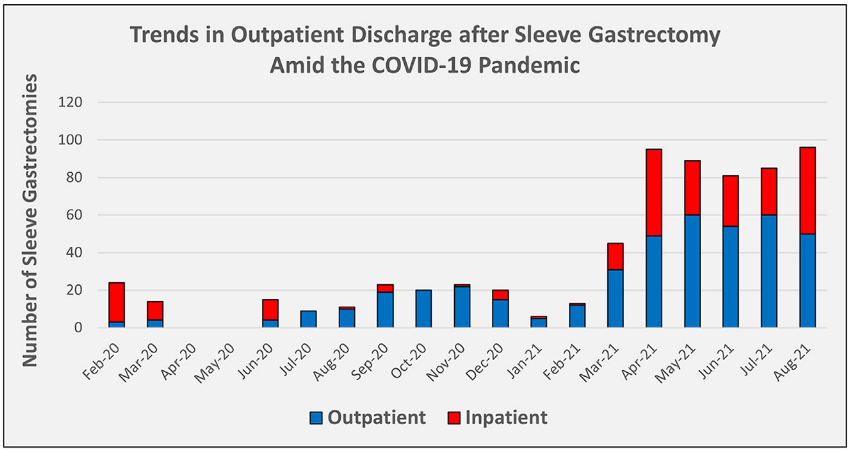

Fig. 1. The frequency of outpatient sleeve gastrectomy at Hospital 1 increased from 13% in February 2020 to 96% in November 2020. After initiation of the outpatient sleeve gastrectomy protocol at all five hospitals, the regional frequency of outpatient sleeve gastrectomy increased as high as 71%.

demonstrated, we are unable to comment on long-term safety. Future studies should emphasize improving patient selection, reducing early ED admission, and confirming the long-term safety after outpatient sleeve gastrectomy.

Conclusion

Outpatient discharge after sleeve gastrectomy is safe and efficacious. Administrative support for extended PACU recovery was critical to successful protocol implementation for outpatient sleeve gastrectomy within this large multicenter healthcare system, demonstrating potential applicability nationwide.

Acknowledgments

We thank Dr. Diane Jackson for her support and advancement of medical and research education. Her strength and guidance demonstrate true affinity as a teacher and educator. As she always likes to say, “If you want something done, ask a busy person.”

Disclosures

The authors have no commercial associations that might be a conflict of interest in relation to this article.

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