

综述

## 代谢手术术前内科管理进展

单颖仪, 于浩泳

上海交通大学医学院附属第六人民医院内分泌代谢科, 上海市糖尿病临床医学中心, 上海市代谢性疾病临床医学中心, 上海市糖尿病重点实验室, 上海 200233

**[摘要]** 肥胖是一种慢性代谢性疾病, 其人数日益增多, 已成为包括中国在内的许多国家的重要公共卫生问题和流行病。肥胖及其合并症如2型糖尿病 (type 2 diabetes mellitus, T2DM)、非酒精性脂肪肝、高血压和心血管疾病等严重危害生命健康。随着代谢手术的不断发展和完善, 其作为一种安全、有效的治疗肥胖及其合并症的方法, 已被广泛应用于肥胖患者的临床治疗中。代谢手术可以帮助患者显著减轻体质量, 改善代谢指标, 降低糖尿病、高血压等慢性病的风险, 改善患者的生活质量, 为患者带来全面的健康益处。然而, 目前临床上缺乏规范的代谢手术术前内科管理, 可能导致患者出现代谢紊乱、营养缺乏等并发症, 从而增加手术风险和术后并发症发生率, 影响减重的效果, 对患者的预后造成不良影响。该文回顾了代谢手术术前减重、血糖控制、血压和血脂控制、微量营养素补充、心理和行为调节等方面的相关文献, 对代谢手术术前内科管理进行综述, 旨在为有效提高代谢手术的安全性和治疗效果, 以及改善患者的预后提供参考。

**[关键词]** 代谢手术; 肥胖; 糖尿病; 内科管理

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## Advances in preoperative medical management of metabolic surgery

SHAN Yingyi, YU Haoyong

Department of Endocrinology and Metabolism, Shanghai Sixth People's Hospital, Shanghai Jiao Tong University School of Medicine; Shanghai Clinical Medical Center of Diabetes; Shanghai Clinical Center for Metabolic Disease; Shanghai Key Laboratory of Diabetes, Shanghai 200233, China

**[Abstract]** Obesity is a chronic metabolic disease that is increasing in prevalence and has become a major public health problem and epidemic in many countries, including China. Obesity and its associated complications, such as type 2 diabetes (T2DM), non-alcoholic fatty liver disease, hypertension, and cardiovascular disease, seriously damage health. With the continuous development of metabolic surgery, it has become a widely used, safe and effective method for treating obesity and its associated complications. Metabolic surgery can significantly lose weight, improve metabolic indicators, reduce the risk of chronic diseases such as diabetes and hypertension, improve the quality of life of patients, and bring comprehensive health benefits to patients. However, there is currently a lack of standardized preoperative medical management for metabolic surgery, which may lead to metabolic disorders, nutrient deficiencies, and other complications, increasing the risk of surgery and postoperative complications, and affecting the efficacy of weight loss and the prognosis of patients. Through the systematic review of literature related to preoperative weight loss, glycemic control, blood pressure and lipid control, micronutrient supplementation, and psychological and behavioral modifications, this paper reviews preoperative medical management of metabolic surgery with the aim of providing reference for effectively improving the safety and efficacy of metabolic surgery and improving the prognosis of patients.

**[Key words]** metabolic surgery; obesity; diabetes; medical management

肥胖是体内脂肪堆积过多导致的一种慢性代谢性疾病, 通常伴随着其他疾病, 例如2型糖尿病 (type 2 diabetes mellitus, T2DM)、非酒精性脂肪肝、高血压、心血管疾病和睡眠呼吸暂停等, 严重危害身体健

康。目前肥胖人数日益增多。据世界卫生组织统计, 2021年全球肥胖人数比1975年增加了近2倍<sup>[1]</sup>。中国成人平均体质量指数 (body mass index, BMI) 和肥胖率从20世纪80年代初期开始持续增长, 其中平

**[作者简介]** 单颖仪 (1997—), 女, 硕士生; 电子信箱: yingyi0508@126.com。

**[通信作者]** 于浩泳, 电子信箱: yuhaoyong111@163.com。

**[Corresponding Author]** YU Haoyong, E-mail: yuhaoyong111@163.com.

均 BMI 从 2004 年的  $22.7 \text{ kg/m}^2$  上升到 2018 年的  $24.4 \text{ kg/m}^2$  [2]。肥胖已成为包括中国在内的许多国家的流行病。因此,及时干预治疗肥胖是十分有必要的。

目前肥胖的治疗包括非手术治疗和代谢手术治疗。与非手术治疗相比,代谢手术在减轻体质量、降低合并症发病率、降低死亡率等方面有更好的疗效 [3-4]。对 T2DM 患者来说,代谢手术带来的益处更为显著。代谢手术是治疗肥胖型 T2DM 的一种有效方法,具有改善血糖控制、减少降糖药物使用、实现糖尿病缓解等多重获益 [5-6]。

随着腹腔镜技术的发展,代谢手术在临床上得到了广泛的应用。2018 年全球代谢手术总数接近 70 万例 [7],而在中国,2010—2015 年期间代谢手术的数量相比于 2001—2005 年期间增加了 148.7 倍 [8]。代谢手术带来的积极效果使得 BMI 下限不断降低。美国减重代谢外科学会 (American Society for Metabolic and Bariatric Surgery, ASMBS)、国际肥胖与代谢病外科联盟 (International Federation for the Surgery of Obesity and Metabolic Disorders, IFSO) 2022 年联合发布声明,  $\text{BMI} \geq 35 \text{ kg/m}^2$  的单纯肥胖者或 BMI 在  $30.0 \sim 34.9 \text{ kg/m}^2$  且有代谢性疾病者可考虑手术 [9]。中华医学会糖尿病学分会 (Chinese Diabetes Society, CDS) 2020 年版指南则表示  $\text{BMI} \geq 32.5 \text{ kg/m}^2$  或有合并症的  $\text{BMI} \geq 27.5 \text{ kg/m}^2$  的患者可选择代谢手术 [10]。

为达到最佳的治疗效果,代谢手术应以良好的临床护理和有循证证据的干预措施为基础,同时注重术前和术后终身多学科管理。然而,目前临床上仍缺乏规范统一的代谢手术术前内科管理意见。因此,本综述对代谢手术术前减重、血糖控制、血压和血脂控制、微量营养素补充、心理和行为调节等方面的相关文献进行总结,以期改善代谢手术前的临床管理提供参考。

## 1 术前减重

肥胖是肝脏疾病的危险因素之一,大多数肥胖患者合并有非酒精性脂肪肝。随着 BMI 的增加,肥胖对肝脏的损害更大,容易出现肝肿大、肝组织异常以及内脏脂肪严重浸润等情况,导致术野暴露困难,增加术中出血的风险;再加上腹腔镜手术术野相对有限和手术器械不易操作等问题,给代谢手术增加不少难

度。而体质量减轻可减小肝脏体积 [11],还可以改善非酒精性脂肪肝组织病变情况 [12]。由此看来,肥胖患者术前适当减重可降低手术难度。除此之外,术前减重还能带来更理想的减重效果 [13]。然而,也有研究 [14] 指出术前体质量变化对术后没有影响。尽管存在争议,已有充分的证据表明术前减重是安全的,并且适当减重可带来一定的手术获益,如降低手术难度、缩短手术时间、减少并发症和住院时间 [15-16]。因此,在代谢手术前 2~4 周内,患者可通过减少 5%~10% 的体质量来获得更佳的疗效 [17]。

为有效实现术前短期内体质量减轻,需制定包括适当锻炼和饮食调节的减重计划。通过进行适当的锻炼,可以提高心肺功能、身体耐力和肌肉力量,改善身体状况,减少手术风险。因此,在患者自身能力和健康状况允许的前提下,推荐每周至少进行 150 min 的中等强度运动 (相当于 3~6 代谢当量),结合有氧运动与阻力训练以达到更好的减重效果 [18]。

热量限制是成功减重的重要先决条件。体质量管理的各种饮食方法本质上都是将热量限制在代谢需求以下。其中低热量饮食 (low calorie diet, LCD) 在减小肝脏体积、改善肝功能方面的优越作用使其成为术前减重的优选方法 [19]。同时, LCD 还能调节血糖、改善胰岛素敏感性 [20]。对于合并 T2DM 的肥胖患者来说, LCD 可能是较适宜的术前减重方法。LCD 是指每日热量限制在 800~1 200 kcal (1 kcal=4.186 J);三大营养物质中,碳水化合物占 50%~60%,脂肪占 25%~35% (<10% 来自饱和脂肪),蛋白质约占 15%。与 LCD 相似,极低热量饮食 (very low calorie diet, VLCD) 同样能减小肝脏体积、减少内脏脂肪浸润和调节血糖 [21],其较低的日均能量摄入 (500~800 kcal),使患者在短时间更有效减轻体质量。然而,需警惕短期内体质量快速下降引起并发症的可能性 [22]。

除了上述几种方法之外,临床上还有其他可以有效减重的方法,例如地中海饮食、高蛋白饮食 (high-protein diet, HP 饮食)、胃内球囊放置 (intra-gastric balloon, IGB) 等。有研究 [23] 提出,改良的地中海饮食 (Mediterranean-protein-enriched diet, MPED) 提高了蛋白质的占比 (蛋白质占 30%,脂肪占 25%,碳水化合物占 45%)。肥胖患者坚持 8 周的 MPED 后,体质量明显降低,内脏脂肪、肝脏体积和总脂肪量显著减少。这些改变都有利于代谢手术的进行。HP 饮食由 40% 碳水化合物、30% 脂肪和 30% 蛋

白质组成。3周的HP饮食不但能有效减重,而且能更有效降低胰岛素抵抗、改善血糖变异性<sup>[24]</sup>。IGB是指在胃内放置一个充满生理盐水的球囊,通过增加饱腹感来限制食物摄入。一项临床试验<sup>[25]</sup>发现,与限制饮食相比,肥胖患者在术前6个月进行IGB减重效果更好;然而,需要注意IGB可引起恶心、呕吐等不适,也可引起胃炎、胃溃疡等并发症。

在各种减重方法中,应根据患者的个体差异选择合适的方法,并在临床医师的指导下进行饮食结构调整。无论选择哪种饮食,都应坚持热量限制,提高饮食依从性,调整饮食结构,只有这样才能发挥术前减重的最大效益。

除锻炼及饮食调节外,不少患者寻求减肥药物以实现理想的体质量管理。减肥药物作为肥胖管理的辅助治疗,适用于BMI $\geq 30$  kg/m<sup>2</sup>,或BMI $\geq 27$  kg/m<sup>2</sup>且有肥胖合并症的患者。目前已获批的药物及药物组合有奥利司他、利拉鲁肽、纳曲酮联合安非他酮、芬特明联合托吡酯等。尽管目前的研究尚未完全明确代谢手术前服用减肥药物的有效性及安全性,但有研究<sup>[26]</sup>显示术前联合减肥药物可实现更大程度地减重。联合减肥药物减重可以帮助患者改善身体状况,保持依从性。在选择是否使用减肥药物之前,需要了解个人的健康状况、药物过敏史等情况,在医师的指导下选择适当的药物及用药方案,并且需要注意避免药物的不良反应<sup>[27]</sup>。

## 2 血糖控制

对于T2DM患者来说,如果代谢手术前糖化血红蛋白(hemoglobin A1c, HbA1c)控制不理想,术后实现糖尿病缓解的可能性则会降低<sup>[28]</sup>。同时,HbA1c升高与减重不理想、术后并发症发生率增加、术后胰岛素的使用等不良结果有关<sup>[29-30]</sup>。因此,严格控制术前血糖,患者获益会更多。根据美国糖尿病协会建议<sup>[31]</sup>,围手术期目标静脉血浆葡萄糖范围为7.8~10.0 mmol/L,而HbA1c需控制在8%以内。若患者并非处于严重的高血糖症状状态(葡萄糖 $> 13.9$  mmol/L)<sup>[32]</sup>,即便血糖尚未控制在目标范围内也不建议延迟手术。

对于非糖尿病患者或未经系统治疗的糖尿病患者,若多次监测到静脉血糖 $> 7.8$  mmol/L,需及时进行干预,如调节饮食、增强运动或调整导致高血糖的

药物;若多次监测到静脉血糖 $\geq 10.0$  mmol/L,提示需要进行胰岛素治疗,使术前血糖控制在目标范围内<sup>[31]</sup>。

对于有手术适应证的1型糖尿病(type 1 diabetes mellitus, T1DM)患者来说,术前不能停止基础胰岛素的使用,可以在术前饮食改变时减少基础胰岛素剂量;其降低幅度应根据自身胰岛素使用模式、血糖波动以及饮食调节情况进行调整<sup>[33]</sup>,并注意密切监测指尖血糖,避免低血糖发生。

在T2DM患者的术前血糖控制方案中,一般将基础胰岛素注射剂作为首选<sup>[31]</sup>。由于饮食改变和体质量减轻引起胰岛素敏感性改善,初始胰岛素剂量需调整为原来的80%,并定期监测血糖,及时调整胰岛素剂量使血糖控制在目标范围内。若血糖超过目标范围,可增加餐时胰岛素;若血糖低于目标范围,可将基础胰岛素剂量减少50%或更多;若空腹血糖水平 $< 4.5$  mmol/L,则可停止胰岛素的使用。

由于使用口服降糖药物和非胰岛素注射剂对血糖控制存在滞后的情况,且存在低血糖、术后恶心等风险,一般不选择其为术前血糖控制方案。患者如果存在以下情况可考虑在医师指导下选用该方案:使用口服降糖药物和非胰岛素注射剂控制日常血糖,且饮食和体质量在术前管理期间没有显著改变;术后出院需使用口服降糖药物和非胰岛素注射剂控制血糖。建议以上患者使用药物至手术前1 d。需要特别注意的是,磺脲类药物和格列奈类药物需在饮食变化(一般术前2~4周)时停用,SGLT2抑制剂则需要手术前至少3 d停用<sup>[33]</sup>。口服降糖药和非胰岛素注射剂的术前治疗建议<sup>[33-34]</sup>具体见表1。

## 3 血压和血脂控制

肥胖人群中高血压患病率极高。血压控制不佳不仅损害身体多个器官和系统,还会对代谢手术造成不利影响。一项多中心观察性队列研究<sup>[35]</sup>发现术前高血压病史可能导致术后体质量减轻不理想。因此,及时控制血压非常重要。由于肥胖合并高血压患者危险分层均在中危及以上,故建议术前血压控制在130/80 mmHg(1 mmHg=0.133 kPa)以下。但血压并非控制得越低越好,需警惕过低血压带来的麻醉风险及术后不良反应。控制高血压的方法包括药物治疗、饮食调整、体育锻炼和减轻体质量等。目前尚无针对代

表1 口服降糖药物和非胰岛素注射剂术前治疗建议

Tab 1 Recommendations for preoperative treatment with oral hypoglycemic agents and non-insulin injectables

Treatment	Preoperative treatment	Note
Metformin	To discontinue on the day of surgery	Gastrointestinal discomfort and lactic acidosis should be avoided; Patients with stage 4 severe chronic kidney disease (CKD) [estimated glomerular filtration rate $30\text{ mL}\cdot\text{min}^{-1}\cdot(1.73\text{ m}^2)^{-1}$ ] are contraindicated
Sulfonylureas and meglitinides	To discontinue at the start of preoperative diet ( <i>i.e.</i> , 2–4 weeks before surgery)	Hypoglycemia and weight gain should be avoided
Thiazolidinediones	To discontinue on the day of surgery	Weight gain, fluid retention, and edema should all be avoided
$\alpha$ -glucosidase inhibitors	To discontinue on the day before metabolic surgery	Gastrointestinal side effects should be avoided
Dipeptidyl peptidase-4 (DPP-4) inhibitors	To discontinue on the day of surgery	Patients with heart failure, arthralgia, skin conditions, allergic reactions and acute pancreatitis should use it with caution
Sodium-glucose cotransporter-2 (SGLT2) inhibitors	To discontinue 3 d prior to surgery (2 weeks prior to surgery for those on a low-calorie ketogenic diet)	Genitourinary tract infections, hypotension, fractures, acute kidney injury, ketoacidosis, and rare cases of Fournier's gangrene should all be taken seriously
Glucagon-like peptide 1 (GLP-1) receptor agonists	To discontinue on the day of surgery	Gastrointestinal side effects should be avoided; Patients with a personal or family history of medullary thyroid carcinoma or multiple endocrine neoplasia type 2 are contraindicated

谢手术前血压管理的指南，因此按照一般外科手术的围手术期血压管理方法进行控制是比较合理的建议。在手术前，根据患者的具体情况，制定个性化的血压管理方案，以确保术前血压控制在合理范围内。

此外，肥胖容易引起血脂异常，建议肥胖患者在术前监测血脂。监测血脂不仅可以明确手术对血脂异常的缓解程度，还可以指导手术方式选择。研究<sup>[36]</sup>指出胃旁路术在改善患者的脂质代谢方面优于袖状胃切除术。尽管目前尚未完全明确不同手术方式对血脂的影响，但术前血脂水平可作为降脂药物选择的证据。临床中通常根据血脂异常类型、基线水平以及需要达到的目标值决定是否启动降脂药物的联合应用。若有干预指征，可在术前根据当前临床实践指南进行降脂治疗<sup>[37]</sup>。

## 4 微量营养素补充

接受代谢手术的患者通常存在1种或多种微量营养素缺乏，中国肥胖患者也普遍存在微量营养素缺乏的情况<sup>[38]</sup>。微量营养素缺乏可能是由于肥胖患者低质量、高热量和多脂肪的单一饮食结构所致。常见缺乏的微量营养素包括维生素D、维生素B<sub>12</sub>、维生素B<sub>6</sub>和铁等<sup>[39]</sup>，其中维生素D缺乏较为常见。人体缺乏维生素D会影响钙磷吸收，容易引起代谢性骨病和骨质疏松症，严重影响骨骼健康；同时体内维生素D缺乏还与增加的甲状旁腺激素（parathyroid hormone，

PTH）循环水平有关，容易引起继发性甲状旁腺功能亢进。其他微量营养素缺乏也容易引起术后并发症，例如：铁缺乏能引起缺铁性贫血，维生素B<sub>12</sub>缺乏可引起韦尼克脑病、感觉异常、肌肉牵张反射减弱以及痉挛等神经系统并发症，维生素B<sub>1</sub>缺乏可引起氧化应激和神经变性，叶酸缺乏可引起巨细胞性贫血、抑郁和癫痫。

有文献指出微量营养素术后缺乏与术前不足有关：术前叶酸和维生素B<sub>12</sub>的缺乏可预测术后1年的缺乏情况<sup>[40]</sup>；术后缺铁可部分归因于术前缺铁<sup>[41]</sup>；术前维生素B<sub>12</sub>和铁蛋白的水平与术后减少独立相关<sup>[38]</sup>。有学者<sup>[42]</sup>认为术前补充微量营养素可避免术后缺乏情况持续存在或加重。此外，由于术后肠道的生理结构改变会影响原有的物质吸收功能，术前识别和治疗营养缺乏显得尤为重要。因此，建议在术前饮食改变时（2~4周）进行相关血液检测以明确有无微量营养素缺乏。若无缺乏，则以预防剂量维持；若有缺乏，则以治疗剂量进行补充，以预防和减轻术后营养缺乏的情况。微量营养素缺乏的预防和治疗方案<sup>[43-44]</sup>见表2。

## 5 心理和行为调节

在肥胖患者吸烟问题的管理方面，有关吸烟会增加手术并发症的风险已有较多报道<sup>[45-46]</sup>，但术前吸烟史对手术预后的影响目前尚无定论。有研究<sup>[47]</sup>显

表2 预防和治疗微量营养素缺乏的方法  
Tab 2 Prevention and treatment of micronutrient deficiencies

Micronutrient	Prevention	Treatment
Iron	45–60 mg/d by oral administration	150–200 mg/d by oral administration
Zinc	15 mg/d by oral administration	60 mg twice a day by oral administration
Copper	2 mg/d by oral administration (≥1 mg Cu per 8–15 mg Zn to prevent copper deficiency is recommended)	Severe deficiency: 2–4 mg/d by intravenous injection for 6 d
Vitamin A	6 000 IU/d by oral administration	Without corneal changes: 10 000–25 000 IU/d by oral administration. With corneal changes: 50 000–100 000 IU by intramuscular injection for 3 d, followed by 50 000 IU/d by intramuscular injection for 2 weeks to achieve clinical improvement
Vitamin B <sub>1</sub>	12 mg/d by oral administration	500 mg/d by intravenous injection for 3–5 d, followed by 250 mg/d by intravenous injection for 3–5 d or until symptoms disappear. If further treatment is required, 100 mg/d is taken by oral administration
Vitamin B <sub>6</sub>	400 μg/d by oral administration	1 000 μg/d by oral administration
Vitamin B <sub>12</sub>	250–350 μg/d or 1 000 μg/wk by sublingual administration	1 000–2 000 μg/d by sublingual administration
Vitamin D <sub>2</sub> or D <sub>3</sub>	Vitamin D <sub>2</sub> or D <sub>3</sub> 3 000 IU/d by oral administration to reach normal concentrations of 30 ng/mL	Vitamin D <sub>2</sub> or D <sub>3</sub> 50 000 IU/week for 8 weeks, followed by maintenance therapy of 1 500–2 000 IU/d by oral administration to achieve normal concentrations
Vitamin E	400 IU/d by oral administration	800–1 200 IU/d by oral administration
Vitamin K	300 μg/d by oral administration	10 mg by intramuscular injection, followed by 1–2 mg/week by oral administration

示，在术前有吸烟史的患者术后减重更多；然而，也有研究<sup>[45]</sup>表明吸烟习惯与术后体质量减轻无关。鉴于吸烟是一个不良的生活习惯，戒烟可以降低并发症的风险及患者死亡率，还可以提高代谢手术患者的满意度和生活质量，因此，建议在术前至少戒烟6周，最好戒烟时长达1年。

与正常人群相比，接受代谢手术的患者心理疾病发病率较高<sup>[48]</sup>。有研究揭示了心理疾病的存在与不良手术结果有关：术前有情绪障碍的患者，术后减重效果较差，甚至有更高的体质量反弹风险<sup>[49]</sup>；与未患有神经性贪食症的患者相比，术前患有神经性贪食症的患者术后减重相对较少<sup>[50]</sup>。然而，不是所有的研究都报告了这种关联：PEKKARINEN等<sup>[51]</sup>没有发现暴食行为与体质量减轻有关；FUCHS等<sup>[52]</sup>的研究结果显示，心理疾病并不会影响术后1年的减重结果。需要注意的是，术后体质量反弹、发生并发症等不良结果可能加重原有的心理疾病；如果不及时干预，可能预后欠佳。由此可见，术前心理疾病的评估和治疗至关重要，可在一定程度上减少术后的不良影响。已有多个指南将术前心理评估纳入术前筛查项目中<sup>[53-54]</sup>。心理评估的方法包括专业的精神心理医师进行临床访谈、完善心理量表等<sup>[55]</sup>。心理疾病程度较轻或经过治疗的患者可进行手术，而严重的心理疾病则是代谢手术的禁忌证。

## 6 总结

目前，代谢手术在治疗肥胖及其并发症方面显示出巨大潜力，特别是对于病态肥胖患者或经过生活方式干预和药物治疗无效的肥胖患者而言，它提供了一种有效的治疗方案。此外，代谢手术在治疗方面表现出的显著改善效果也吸引了越来越多肥胖患者选择代谢手术作为治疗手段。因此，在进行代谢手术之前，需要进行规范的术前内科管理，以确保手术的安全性和有效性。本综述有以下局限性：文献资料主要来源于国外，国内的相关数据较少；有关治疗方法选择和治疗效果的文献尚未形成统一论，笔者主要综合治疗的最大益处提出建议。尽管代谢手术确切机制尚未清楚，但根据近年来的研究，术前体质量变化，血糖、血压、血脂的控制，微量营养素的情况以及心理和行为状态等因素与手术效果密切相关。这些因素需要在手术前进行充分评估和管理，以优化手术效果、改善患者的健康状况。随着代谢手术研究的不断深入，需要提供更多的临床试验数据和完善相关管理体系。在术前准备阶段，需要针对体质量、血糖、血压和血脂等方面采取控制措施，同时还需要进行微量营养素的补充，以及进行心理和行为调节等综合性管理，形成多学科管理模式，以达到更佳手术效果，并逐渐形成实践标准，使其成为治疗肥胖及其相关合并症的有力手段。

### 利益冲突声明/Conflict of Interests

所有作者声明不存在利益冲突。

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### 作者贡献/Authors' Contributions

单颖仪参与了综述构思、写作和修改,于浩泳参与了综述构思和审校。所有作者均阅读并同意了最终稿件的提交。

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