

妇科肿瘤围手术期管理的革命：从ERAS到预康复的系统性优化

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摘要

妇科肿瘤约占全球女性新发癌症病例的15%，其围手术期管理面临传统护理模式预后不佳、循证依据薄弱、医疗质量异质性显著，以及高龄患者风险分层不完善、急性失血容量管理无统一标准等挑战。本文系统综述了妇科肿瘤围手术期管理的最新进展，重点探讨了从加速康复外科(Enhanced recovery after surgery, ERAS)到预康复策略的系统性优化路径。文章指出，传统围手术期护理模式存在住院时间长、并发症控制不佳及资源消耗大等问题，而ERAS通过多学科协作、微创技术、目标导向液体管理等核心要素，显著改善患者短期恢复结局。预康复作为新兴策略，通过术前运动、营养与心理干预提升患者生理及心理储备，与ERAS形成有效互补。文章还分析了特殊患者群体(如高龄、合并症及急性失血患者)的个体化管理策略，并探讨了人工智能在风险预测与个体化治疗中的潜在应用。尽管当前存在方案依从性不均、长期肿瘤学结局证据不足等挑战，整合ERAS与预康复的多模式干预方案仍是未来优化妇科肿瘤围手术期管理的关键方向。

关键词

妇科肿瘤, 围手术期管理, ERAS (加速康复外科), 预康复, 多学科协作

The Revolution in Perioperative Management of Gynecologic Oncology: Systematic Optimization from ERAS to Prehabilitation

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Abstract

Gynecologic tumors account for approximately 15% of new cancer cases in women worldwide. Their perioperative management faces multiple challenges, including poor prognosis of traditional care models, weak evidence base, significant heterogeneity in medical quality, inadequate risk stratification for elderly patients, and lack of unified standards for acute blood loss volume management. This article systematically reviews the latest progress in perioperative management of gynecologic tumors, focusing on the systematic optimization path from Enhanced Recovery After Surgery (ERAS) to prehabilitation strategies. It points out that traditional perioperative care models have problems such as long hospital stays, poor complication control, and high resource consumption. In contrast, ERAS significantly improves patients' short-term recovery outcomes through core elements including multidisciplinary collaboration, minimally invasive techniques, and goal-directed fluid therapy. As an emerging strategy, prehabilitation enhances patients' physical and psychological reserves through preoperative exercise, nutrition, and psychological interventions, forming an effective complement to ERAS. The article also analyzes individualized management strategies for special patient groups (e.g., elderly patients, those with comorbidities, and patients with acute blood loss) and explores the potential application of artificial intelligence in risk prediction and individualized treatment. Despite current challenges such as uneven protocol compliance and insufficient evidence for long-term oncological outcomes, multimodal intervention regimens integrating ERAS and prehabilitation remain the key direction for optimizing perioperative management of gynecologic tumors in the future.

Keywords

Gynecologic Oncology, Perioperative Management, ERAS (Enhanced Recovery After Surgery), Prehabilitation, Multidisciplinary Collaboration

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1. 引言与研究价值定位

1.1. 妇科肿瘤围手术期管理面临的多方面临床挑战

妇科肿瘤在全球女性新发癌症病例中的占比约为 15%，其围手术期管理面临多重临床挑战。现有证据表明，传统围手术期护理模式中的部分措施不仅缺乏必要性，且可能对患者预后产生不利影响，具体体现为术后住院时间延长、并发症控制效果欠佳，以及医疗资源消耗过高。在妇科肿瘤专科场景下，围手术期护理实践的循证决策依据仍较为薄弱[1]，这一现状直接导致不同医疗机构间护理质量呈现显著异质性[2]。当前，针对高龄及合并基础疾病的患者，其围手术期风险分层体系尚不完善[3]；针对急性失血等特殊场景，临床所需的容量管理方案也缺乏统一标准[4]，这些因素共同加剧了围手术期管理的复杂性。此外，种族因素引发的妇科肿瘤围手术期护理差异具有普遍性[5]，这一现象提示临床实践中需构建更具包容性的围手术期管理策略。

1.2. ERAS 与预康复的概念演进与理论基础

在妇科肿瘤领域，加速康复外科(ERAS)计划已成为传统围手术期护理的重要替代方案[1]，其核心

理论基础围绕“减少手术应激反应、促进患者早期康复”两大原则展开[6]。多项研究证实,该方案能显著缩短患者术后住院时间、降低医疗支出,且不会增加并发症发生率与死亡率[1]。与此同时,预康复作为围手术期管理的新兴理念,核心目标是通过术前系统性优化患者生理储备及心理韧性[7],提升其对手术应激的耐受能力[8]。其实践框架通常以运动、营养及心理干预为核心的三联模式[9],与 ERAS 在妇科肿瘤围手术期管理中形成明确互补关系[8]。值得注意的是,预康复不仅聚焦手术短期结局,更通过提高治疗依从性、可能改善患者长期预后[10],为妇科肿瘤围手术期管理体系补充了更具整体性的理论支撑。

1.3. 多学科协作模式在围手术期管理中的必要性

妇科肿瘤围手术期管理的复杂性,对多学科协作模式的构建提出明确临床需求[6]。结直肠外科、肝胆外科及妇科肿瘤学领域专家依托改良 Delphi 共识模型[3],共同制定 ERAS 专项方案的标准化内容。临床实践证实,由妇科肿瘤专科护士主导协调的跨学科团队,可显著提升护理方案的执行依从性[2]。美国临床肿瘤学会、妇科肿瘤学会等权威专业组织已启动“包容、多样性、公平与可及性”专项倡议[11],为多学科协作机制的落地运行提供制度支撑。在实施维度,ERAS 路径需整合覆盖术前评估、术中管理及术后随访的全流程协作体系[12],尤其要将麻醉科的麻醉管理方案、营养科的营养支持方案及心理科的心理干预方案,系统融入妇科肿瘤专科护理实践[13]。该多学科协作模式不仅可优化患者临床结局,还能借助标准化协议缩小不同医疗机构间的临床实践差异[14]。

2. ERAS 在妇科肿瘤手术中的应用进展

2.1. ERAS 核心要素与实施路径

妇科肿瘤手术中 ERAS 方案的核心要素,涵盖多学科协作、术前生理优化、微创手术技术、目标导向液体管理及术后早期活动促进等关键维度[15]。与传统围手术期管理模式相比,ERAS 方案依托标准化临床路径有效降低治疗异质性,其实施路径包含术前患者教育、术中体温管理、限制性输液策略及多模式镇痛等 20 余项循证干预措施[16]。在妇科肿瘤领域,ERAS 的临床实施可使患者术后住院时间平均缩短 2~3 天,且未增加并发症发生率及再入院率[1]。值得注意的是 ERAS 方案在妇科肿瘤患者中的实施效果与护理团队的执行依从性高度相关,尤其当由妇科肿瘤专科护士主导协调术后护理时,可实现更高的协议执行率[17]。

2.2. 妇科肿瘤特异性 ERAS 方案优化

针对妇科肿瘤患者的个体化需求,ERAS 方案需开展特异性优化。Delphi 共识研究明确 27 项适用于妇科肿瘤领域的 ERAS 建议,其中术前营养评估与干预、个体化血栓预防方案及术后早期肠内营养支持被界定为核心优化项目[18]。多中心研究数据表明,需针对手术复杂程度差异(如根治性子官切除术与盆腔廓清术)采用差异化 ERAS 路径,其中中低复杂度手术的 ERAS 要素完成率可达 78%,高复杂度手术则为 62% [9]。针对老年妇科肿瘤患者,优化后的 ERAS 方案借助阿片类药物节约策略,显著降低术后恶心呕吐发生率(12 小时内降幅约 40%) [19]。此外,整合移动健康技术可进一步提升术后随访质量,使用专用 APP 的患者在疼痛评分与功能恢复指标上均优于传统随访组[20]。

2.3. ERAS 实施中的关键争议与解决方案

ERAS 在妇科肿瘤领域的应用仍存在若干争议点。首要争议点在于方案依从性的人群差异,研究表明黑人患者在妇科肿瘤 ERAS 实施中的护理不依从率显著高于其他人群,这提示需针对不同人群制定差

异化执行策略[17]。其次,关于 ERAS 对患者长期肿瘤学结局的影响,目前仍缺乏高质量循证证据,现有研究多聚焦于术后短期恢复指标[21]。针对性解决方案包括构建 ERAS 专用手术安全核查表,通过标准化提示强化各环节执行率,Delphi 研究显示该方法可使关键要素的共识达成率提升至 70%以上[18]。此外,针对体质量指数 $\geq 28\text{kg/m}^2$ 的特殊人群,改良版 ERAS 方案可体现更显著的恢复优势,提示需依据患者个体特征开展方案调整[4]。在争议度最高的术前肠道准备环节,妇科肿瘤手术领域的现有证据支持减少机械性肠道准备的应用,转而采用碳水化合物负荷等更符合生理需求的替代方案[6]。

3. 预康复策略的系统性构建

3.1. 多模式预康复的理论框架(运动 - 营养 - 心理)

多模式预康复是一种以患者为中心、依托循证依据且强调多学科协作的围手术期管理策略,其核心理念是将优化干预的时机从传统术中及术后阶段主动前移至诊断初期[20] [22]。该模式通过整合运动训练、营养支持与心理干预三大支柱策略,核心目标是提升患者术前功能储备与生理代偿能力,进而增强其对手术应激的耐受水平[20]。运动干预涵盖有氧运动(如中等强度持续训练)、抗阻训练及针对特定手术类型的呼吸肌训练,各类训练通过差异化机制改善患者心肺功能与肌肉力量[23];营养优化以调控肌肉蛋白质合成代谢为核心,通过补充特定营养素纠正患者术前营养不良状态[24];心理干预则聚焦于缓解手术相关焦虑、强化治疗依从性,构建生物 - 心理 - 社会一体化干预模式[7]。该多维度干预的协同效应已被证实可显著提高危患者的功能容量,为后续手术应激提供更充足的生理缓冲空间[19] [25],但对患者长期肿瘤学结局的改善仍需进一步验证。

3.2. 术前功能评估与个体化方案制定

有效的预康复实施依赖于精准的术前功能评估体系,该体系需整合客观生理指标与主观生活质量评价,形成系统化评估框架[7] [26]。心肺运动试验中测定的通气/二氧化碳斜率是预测术后肺部并发症的重要指标,常被用于指导呼吸肌训练强度的个体化调整[25]。针对妇科肿瘤患者,还需特别评估盆底肌群功能与淋巴水肿风险,为此需构建包含肿瘤特异性参数的多维度评估模型[9] [27]。基于评估结果,预康复方案需动态调整:针对心血管高风险患者,推荐采用高强度间歇训练并配合严密监护[23] [28];针对肌少症患者,则需侧重抗阻训练联合蛋白质补充[20] [24]。在时间维度上,现有证据表明,4~6 周的中等周期干预可实现最佳效益,训练频率通常为每周 3~6 次,每次持续 60 分钟[29] [30]。值得注意的是,数字技术的融入使通过移动健康平台开展远程监测与方案调整成为可能,显著提升了真实世界场景下的实施可行性[31] [32]。

3.3. 高强度训练对功能储备的影响机制

高强度训练作为预康复的关键组成部分,其生理效应主要通过多维度机制发挥作用:在呼吸系统层面,针对通气/二氧化碳斜率的高强度呼吸肌训练可改善通气效率,使肺切除术后肺部并发症发生率降低 35%~40% [25]。在代谢层面,高强度间歇训练通过激活 AMPK-PGC-1 α 信号通路增强线粒体生物合成,进而提升术后胰岛素敏感性与氧利用效率[24] [28]。针对肿瘤患者,高强度运动还能调控系统性炎症反应,降低 IL-6 等促炎因子水平,这可能与降低术后感染风险相关[28] [33]。临床研究显示,接受 14 天高强度预康复(涵盖呼吸训练、营养支持及心理干预)的患者,术后机械通气需求显著降低,住院时间平均缩短 2.3 天[25] [34]。但实施过程中需重点关注心血管风险评估与运动监护,尤其针对合并基础疾病的老年人群,建议采用分级强度递增方案以保障安全性[23] [31]。上述机制共同阐释了高强度预康复为何能更高效构建“生理储备银行”,助力患者应对手术引发的代谢挑战[7] [35]。

4. 围手术期关键环节的技术革新

4.1. 目标导向液体管理的血流动力学优化

目标导向液体管理(GDFM)作为围手术期血流动力学优化的重要策略,在妇科肿瘤手术中展现出明确优势。多项随机对照研究表明,与传统液体管理方案相比,GDFM可显著降低晶体液输注速率(5.4 vs 7.0 ml/kg/h)和胶体液输注速率(1.1 vs 1.7 ml/kg/h),同时维持更理想的液体平衡量(0.3 vs 1.9 ml/kg/h) [28] [36]。其核心机制在于通过动态监测每搏量变异度、心输出量等血流动力学参数,实现个体化液体输注方案的制定[37] [38]。值得注意的是,脑肿瘤手术领域的研究显示,尽管 GDFM 能显著减少静脉输液量,但对术后脑水肿的改善效果尚不明确[27],该结论在妇科肿瘤手术领域仍需进一步验证。当前 GDFM 的临床实施仍面临算法复杂等挑战,Acumen 辅助液体管理系统等新型辅助系统或可为该问题提供解决方案[32]。

4.2. 微创手术与 ERAS 的协同效应

微创手术技术与 ERAS 方案在妇科肿瘤领域展现出明确的协同效应。数据显示,2012~2017 年间微创手术在妇科肿瘤中的应用率从 45.6%显著提升至 75.3% [39]。在良性妇科手术中,微创技术的并发症发生率显著低于开腹手术,以卵巢囊肿切除术为例,两者发生率分别为 3.1%与 22.9% [40]。该优势在 ERAS 框架下进一步放大,meta 分析显示,ERAS 方案可将接受微创减重手术患者的总体并发症发生率从 17.6%降至 7.6% [22] [41]。特别值得关注的是,ERAS 在微创肝手术中的应用同样呈现类似积极效果($P=0.036$) [41],这为妇科肿瘤微创手术的 ERAS 方案优化提供了参考。然而,2018 年后妇科肿瘤领域微创手术应用率呈现下降趋势(从 50.4%降至 11.4%) [39]。这一变化主要源于对微创手术可能增加肿瘤复发风险的担忧,多项研究指出,微创手术在部分宫颈癌病例中的复发率和总生存率低于开腹手术[42]。然而,针对高危子宫内膜癌患者,微创手术在疾病无进展生存率和总体生存率上与开腹手术无显著差异[43],表明临床决策需根据肿瘤类型、分期及患者个体情况进行个性化评估,以权衡手术益处与潜在复发风险。

4.3. 实验室监测的精准化与成本效益分析

围手术期实验室监测的精准化发展为妇科肿瘤围手术期管理提供了新方向。腹膜液来源的小细胞外囊泡其相关分析可作为卵巢癌临床预后的新型生物标志物[44],该液体活检技术可作为术中和术后监测的微创工具。在成本效益维度,ERAS 方案在妇科肿瘤领域的实施已被证实可降低医疗成本[25],但方案中具体实验室监测项目的投入产出比仍需进一步细化评估。现有证据显示,将传统实验室指标与新型生物标志物进行联合监测,或可实现效益最优平衡[45]。值得关注的是,在液体管理领域,尽管 GDFM 需额外投入监测设备,但其通过减少液体相关并发症,或可从整体上优化成本效益[36] [46]。未来需开展更多针对妇科肿瘤特异性实验室监测方案的经济学评估研究。

5. 特殊患者群体的管理策略

5.1. 急性失血患者的容量管理方案

妇科肿瘤手术中急性失血患者的容量管理,需依托患者血液管理策略开展针对性优化。研究表明,通过强化围手术期动态监测并落实患者血液管理方案,可显著改善急性失血患者的临床预后[40]。在容量管理方案构建中,需重点关注隐匿性失血对患者免疫微环境的扰动,该因素可能延缓术后恢复进程[47]。此外,目标导向液体治疗策略的临床应用已被证实可有效优化患者血流动力学状态,对急性失血人群的意义尤为突出[48]。

5.2. 高龄与合并症患者的风险分层

针对高龄及合并基础疾病的妇科肿瘤患者围手术期管理,术前衰弱筛查及优化工具包的应用展现出明确临床价值。多项研究证实,该工具可改善老年癌症患者大手术后的功能恢复效果,并降低并发症发生率[49]。风险分层过程中,需综合纳入年龄、术前营养状态及术后并发症发生风险等多维度因素[50]。针对子宫癌患者,需重点关注静脉血栓栓塞的风险分层,当前该领域仍缺乏统一明确的评估标准[51]。此外,术前认知功能与身体功能评估,可作为老年妇科肿瘤患者围手术期临床决策的可靠预测指标[52]。

5.3. 术后长期功能恢复的监测体系

术后长期功能恢复监测体系的构建需覆盖多维度内容。研究证实,术后肌少症(即急性肌肉丢失)是影响癌症切除术后患者长期功能恢复的关键因素,可导致恢复期延长、生活自理依赖性增加及生活质量下降[53]。监测指标选择方面,需重点关注术后踝关节功能恢复等具象化功能评估指标[54]。数字化技术在术后随访中的应用,为长期功能恢复监测提供了新型技术支撑[55]。此外,术后活动限制的传统认知需重新审视,而微创手术与 ERAS 项目的临床实施,已证实可显著缩短住院时间并推动患者更快恢复[55],但对术后 1 年以上长期功能状态的持续改善效果仍需更多长期随访数据支持。

6. 当前局限性与未来方向

6.1. 方案依从性的提升策略

当前妇科肿瘤围手术期管理面临医护人员对 ERAS 方案依从性不足的挑战。研究表明,专科护士主导的标准化术后护理可显著提高 ERAS 执行率,而普通病房的执行率仍存在波动[1]。提升依从性需建立多学科协作机制,包括制定执行清单、专项培训和电子化监测系统。CFIR (Consolidated Framework for Implementation Research)框架在 ERAS 预康复领域的应用显示,预康复通过营养优化、纠正贫血等措施提升手术耐受性,但其全球推广仍受限于资源不足、医护人员抵触、患者认知缺乏及经济限制等障碍[7] [9] [21] [56] [57]。促进因素包括专家指导、个性化方案和社会支持等[10] [58]。CFIR 2.0 版本进一步强调实施公平性和创新接受者的重要性[59]。早期采用实施框架有助于简化复杂干预措施的识别和报告,从而提高预康复效果[60]。总体而言,预康复的实施需要多层面策略克服障碍并利用促进因素,以实现最佳患者结局[8] [20]。

6.2. 长期肿瘤学结局的循证证据缺口

现有关于 ERAS 与预康复在妇科肿瘤领域的研究多聚焦于短期临床结局,针对长期肿瘤学结局的高质量循证证据仍较匮乏。当前多数人工智能辅助围手术期管理相关研究样本量偏小(95%的研究纳入病例数不足 500 例),且多缺乏多中心验证数据[61]。尤其在卵巢癌、子宫内膜癌等妇科恶性肿瘤领域,预康复干预对 5 年生存率、无进展生存期等关键肿瘤学指标的影响,仍存在明显证据缺口[61] [62]。未来研究需构建标准化长期随访体系,并依托前瞻性队列研究收集高质量肿瘤学结局数据[63]。

6.3. 人工智能在风险预测中的潜在应用

人工智能技术在妇科肿瘤围手术期风险预测中展现出明确应用潜力。最新研究证实,AI 算法可通过整合电子健康记录、临床数据及影像学特征,实现对妇科肿瘤患者(重点为宫颈癌、卵巢癌及子宫内膜癌)的精细化风险分层[64] [65]。在围手术期管理场景中,基于人工智能的智能监测系统可实现健康状态自动评估与治疗方案辅助推荐,该功能对优化老年患者连续性护理具有特殊意义[66]。然而,当前 AI 在该

领域的应用仍面临数据异质性、算法可解释性等核心挑战，未来需通过融合多组学数据、开发新型深度学习架构，进一步提升预测模型的临床适用价值[67][68]。值得关注的是，美国食品药品监督管理局已批准多款 AI 辅助诊断设备用于肿瘤领域，为围手术期 AI 工具的临床转化提供了监管依据[69]，但 AI 模型在妇科肿瘤围手术期管理中的实际临床获益仍需大规模多中心临床试验验证。

7. 总结与临床实践建议

7.1. 多模式干预方案的核心要素

妇科肿瘤围手术期管理的多模式干预方案，需整合 ERAS 与预康复策略的核心要素，具体包括：1) 术前教育与咨询，通过标准化实施流程提升患者方案依从性[70]；2) 构建多维度预康复计划，系统结合运动训练、营养优化及心理干预；3) 目标导向围手术期管理，涵盖个体化镇痛方案与动态血流动力学监测[36][71]；4) 微创手术技术与 ERAS 路径的协同实施[69]。循证证据显示，该整合模式可显著缩短住院时间(平均降幅 30%)、降低并发症发生率，且不增加再入院风险[68][72]。特别值得关注的是，当方案由妇科肿瘤专科护士协调的多学科团队执行时，护理依从性可提升 40%以上[69]。但该模式对患者长期肿瘤学结局的改善作用仍需长期随访研究进一步证实。

7.2. 从证据到实践的实施路径

妇科肿瘤围手术期多模式干预方案的成功实施，需构建三级转化路径：1) 制度层面，需将 ERAS 核心方案嵌入电子病历系统，例如通过整合 Caprini 风险评估模型，已实现静脉血栓预防规范率从 45%提升至 82%[73]；2) 团队层面，需组建涵盖外科医生、麻醉师、专科护士及康复师的核心协作小组，并采用标准化医嘱集与每日目标清单规范执行流程[74]；3) 患者层面，需开发移动健康应用程序用于术前教育与术后随访，临床试验数据显示，使用该类 App 的患者疼痛评分降低 35%，功能恢复速度提高 28%[18]。方案实施的关键障碍包括：医疗机构间方案执行差异(仅 23%的医院采用统一标准)，以及老年患者对多模式镇痛的耐受性不足[75]。建议通过构建区域性多中心协作网络，开展经验分享与质量审计以推动方案同质化实施[76]。

7.3. 围手术期管理质量评价指标体系

妇科肿瘤围手术期管理需建立三级质量评价框架：1) 过程指标：涵盖预康复计划完成率(目标值>80%)、术中体温维持达标率(维持在>36℃)及早期肠内营养实施率(术后 24 小时内启动)[66][74]；2) 结局指标：重点监测术后 30 天主要并发症发生率、非计划再手术率，以及核心患者报告结局[77]；3) 系统指标：包括方案依从性审计频率(建议每季度 1 次)与跨学科会议召开频次[1]。数字化监测平台可实现 90%以上核心指标的实时采集，依托机器学习算法可达成 85%术后并发症风险的预测[17]。值得关注的是，质量改进需特别重视医疗公平性，目前非裔患者在部分医疗环节的护理差异仍达 20%[69][78]。

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