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库欣综合征的诊断方法研究进展

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摘　要

库欣综合征是下丘脑－垂体－肾上腺轴调控异常引发的慢性皮质醇增多的一类疾病，是内分泌科公认的疑难疾病。其诊断受皮质醇分泌波动、患者个体差异及检测技术等因素干扰，漏诊误诊率较高。本文系统梳理近年库欣综合征诊断领域的研究进展，重点评价了定性诊断中24小时尿游离皮质醇、深夜唾液皮质醇、小剂量地塞米松抑制试验、毛发皮质醇检测的适用人群与局限性；分析了定位诊断中影像学检查、功能试验及双侧岩下窦采血的诊断效能与应用场景；同时介绍了新型诊断技术的研究成果。本文旨在为临床规范化应用库欣综合征生化检测提供理论依据与实操指导。

关键词

库欣综合征，皮质醇，功能诊断试验，影像诊断

Research Progress in Diagnostic Methods of Cushing's Syndrome

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Abstract

Cushing's syndrome (CS), characterized by chronic glucocorticoid excess due to dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis, remains one of the most formidable diagnostic challenges in clinical endocrinology. Diagnostic precision is often compromised by episodic cortisol secretion, inter-individual variability, and technical disparities in laboratory assays, leading to significant rates of misdiagnosis. This review synthesizes recent advancements in CS diagnostics, specifically evaluating the clinical utility and limitations of 24-hour urinary free cortisol (UFC), late-night salivary cortisol

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(LNSC), low-dose dexamethasone suppression test (LDST), and hair cortisol analysis for qualitative screening. Furthermore, the diagnostic efficacy of imaging modalities, functional assays, and bilateral inferior petrosal sinus sampling (BIPSS) for etiological localization is analyzed. Emerging diagnostic technologies are also discussed. This paper aims to provide a standardized framework and practical evidence for the biochemical evaluation of Cushing's syndrome in clinical practice.

Keywords

Cushing's Syndrome, Cortisol, Dynamic Function Tests, Diagnostic Imaging

1. 引言

库欣综合征(Cushing's syndrome, CS)是由于下丘脑–垂体–肾上腺(hypothalamic-pituitary-adrenal, HPA)轴调控功能异常导致慢性皮质醇过量暴露引发的一组临床综合征[1]，是内分泌临床诊疗中诊断难度极高的疾病。近年流行病学数据显示，CS 的全球估计发病率为每年每百万人 1.8~4.5 例[1]-[4]，根据病因可分为内源性 CS 与外源性 CS，最常见的类型是外源性 CS，其病因是外源性糖皮质激素的使用，包括口服、静脉输注、外用或吸入性糖皮质激素。内源性 CS 中，促肾上腺皮质激素(adrenocorticotropic hormone, ACTH)依赖性库欣综合征占总数的 80%以上[4]-[6]。其中库欣病(Cushing's disease, CD)由垂体 ACTH 腺瘤引起，是 ACTH 依赖性 CS 最常见的类型，占 80%~90% [2] [7]。异位 ACTH 综合征(ectopic ACTH syndrome, EAS)是由来源于甲状腺、胸腺、肺、胃、十二指肠及胰腺等的神经内分泌肿瘤分泌 ACTH，约占 ACTH 依赖性 CS 病例的 10%~20% [6] [8] [9]。除此之外，约 15%~20%的内源性 CS 病因为肾上腺皮质自主分泌过量皮质醇，属于 ACTH 非依赖性库欣综合征，如肾上腺皮质腺瘤、肾上腺皮质癌、双侧肾上腺结节样增生等。

目前临床针对库欣综合征的各类检测手段均有适用场景与一定的缺陷，检测结果受库欣综合征严重程度、病程阶段、皮质醇分泌生理性波动、患者年龄、合并症、用药史等个体因素影响，同时实验室检测技术的差异也会直接干扰检测准确性。本文基于近年最新研究证据，系统性评价各种检测方法在库欣综合征的定性诊断及定位诊断方面的优势与不足，明确不同检测手段的适用人群与禁忌场景，为临床规范化应用库欣综合征检测方式提供理论依据与实操指导。

2. 库欣综合征的定性诊断

筛查库欣综合征前需先排除生理性干扰因素，任何应激状态均会生理性激活 HPA 轴，导致各种标本的皮质醇浓度升高，干扰检测结果，包括感染、创伤等躯体应激，酗酒、抑郁症、精神疾病等心理应激，需在筛查前优先排除[7] [10] [11]。

除临床表现典型的显性库欣综合征外，内分泌学会临床实践指南明确推荐临床疑似患者初始筛查需至少选择以下一项检测：24 小时尿游离皮质醇(urinary free cortisol, UFC)、深夜唾液皮质醇(late-night salivary cortisol, LNSC)、小剂量地塞米松抑制试验(low-dose dexamethasone suppression test, LDDST) [7] [12]。由于皮质醇分泌的波动性，LNSC 与 UFC 检测必须重复 2 次以避免漏诊、误诊。

2.1. 小剂量地塞米松抑制试验

LDDST 的核心原理是评估糖皮质激素对 HPA 轴的生理性负反馈调节功能是否正常，是库欣综合征

筛查的经典手段。给药后血清皮质醇 > 50 nmol/L (1.8 μg/dl)提示未被抑制提示为库欣综合征，诊断的灵敏度约 98.6%，特异度约 90% [13]。地塞米松胃肠道吸收障碍导致血清地塞米松水平异常降低是假阳性的重要原因，可见于减重手术患者[14]、多重用药者、CYP3A4 酶诱导剂使用者[12]；健康人群中也存在地塞米松代谢个体差异，6%的健康人血药浓度低于诊断阈值[13]。同步检测皮质醇与地塞米松可校准结果[15]，但检测可及性差、成本高，不适用于常规筛查。目前临床检测的血清皮质醇浓度为游离态与结合态激素的总和，因此会受皮质醇结合球蛋白(corticosteroid-binding globulin, CBG)及白蛋白浓度波动的影响。有研究显示，在平均白蛋白浓度 21 g/L 的肝功能障碍患者中，46%的患者肾上腺储备充足但总皮质醇小于 550 nmol/L [16]。相反地，口服避孕药女性、绝经后雌激素替代治疗者摄入雌激素会导致 CBG 显著升高，LDDST 假阳性率高达 50% [12] [17]。另外，研究发现年龄每增加 10 岁、肾小球滤过率每降低 10 ml/min/1.73m^2，LDDST 后血清皮质醇升高约 5 nmol/L [18]，老年肾功能异常患者如出现轻度异常结果需谨慎解读。

2.2. 24 小时尿游离皮质醇

皮质醇昼夜节律消失是所有严重程度库欣综合征均存在的特征性生化异常。UFC 检测的是 24 小时游离皮质醇总量，反映全天皮质醇整体分泌水平，是临床常用筛查手段。由于其仅检测游离皮质醇，不受 CBG 浓度变化干扰，适用于雌激素使用者等 CBG 异常人群。但 24 小时尿液完整收集难度大，需患者严格配合，同步检测尿肌酐可评估尿液收集完整性；UFC 依赖肾脏滤过功能，肌酐清除率 < 60 ml/min 时检测值显著下降[19]，因此，轻度库欣综合征合并中度肾功能不全的患者不推荐使用该检测。

2.3. 深夜唾液皮质醇

多项临床研究证实，轻度库欣综合征患者中，LNSC 的诊断效能显著优于 UFC [13] [20]-[23]，尤其适用于 UFC 仅轻度升高的疑似病例。但 LNSC 浓度随年龄、高血压及糖尿病状态升高，并且轮班工作者、作息不规律者存在皮质醇昼夜节律偏移，难以界定 LNSC 检测适用不同场景的临界值[24]。一项研究表明，更推荐按照个人就寝时间进行 LNSC 采样，而非固定在夜间 11 至 12 点，所测得的唾液皮质醇水平相比夜间结果相当，甚至更优[25]。

3. 库欣综合征的定位诊断

库欣综合征确诊后，首要步骤是通过检测血浆 ACTH，判断库欣综合征为 ACTH 依赖性或非依赖性。异位 ACTH 综合征患者血 ACTH 水平呈显著升高，多数 > 100 pg/ml，部分病例可达 500 pg/ml 以上；库欣病病人血 ACTH 水平多为轻度至中度升高，范围约 20~100 pg/ml，少数病例可处于正常参考范围，但无明显降低；肾上腺源性、外源性库欣综合征病人血 ACTH 水平显著降低甚至无法检测。然而，一项多中心研究提示，ACTH 检测的批内与批间变异度较高，低 ACTH 值的解读尤其需要谨慎[26]。

ACTH 依赖性库欣综合征主要分为库欣病与异位 ACTH 综合征，二者在生化表型、临床症状上存在高度重叠，但其治疗方案与长期预后存在显著差异，治疗前精准明确病因、有效鉴别 CD 与 EAS，是制定个体化治疗策略、改善患者临床结局的核心前提，也是当前内分泌领域 CS 诊疗中的重点难点问题。目前国内外指南与专家共识推荐的 CD 与 EAS 鉴别手段各有优劣，均存在一定的临床应用局限。

3.1. 影像学检查

垂体增强磁共振成像(Magnetic Resonance Imaging, MRI)是诊断 CD 的首选影像学检查。70%以上的分泌 ACTH 的垂体肿瘤为微腺瘤，有 25%~45%的微腺瘤在 MRI 中无法检测，多达 40%的确诊库欣病患者 MRI 为阴性。MRI 诊断 CD 的总体敏感度为 73.4% [27]，因为垂体内异常的 MRI 信号可能不一定表明

功能性腺瘤，有 10%的普通人群存在垂体偶发瘤[28]，在 EAS 患者中也可合并垂体无功能腺瘤而导致 MRI 出现假阳性结果。目前认为，在患有 ACTH 依赖性高皮质醇血症的患者中如果发现长度 ≥10 毫米腺瘤，则可以确诊库欣病，如未发现肿瘤或肿瘤长度小于 6 毫米应进行 BIPSS。专家对 6~9 毫米长度的肿瘤存在不同意见，但大多数建议在此情况下使用 BIPSS [7]。胸部和腹部薄层计算机断层扫描(Computed Tomography, CT)或增强 MRI 是寻找异位 ACTH 肿瘤的基础手段。但肺部 NETs 常因体积微小、位于肺门附近或紧邻血管，在 CT 或 MRI 上难以与正常血管结构区分。

在隐匿性 EAS 病例中，常规影像学可能漏诊高达 30%的病灶，此时分子影像学是重要补充。^{68}Ga-生长抑素受体(somatostatin receptor, SSTR) PET/CT 是目前诊断分化良好的 NETs 最敏感的手段，该技术利用神经内分泌肿瘤表面高表达的生长抑素受体，其总体灵敏度约为 82%，在常规检查阴性的隐匿性病例中灵敏度甚至可达 100% [29]。高皮质醇血症可能抑制生长抑素受体的表达，导致假阴性。临床上可在应用降皮质醇药物使激素水平下降后再行检查，以提高显像清晰度[30]。^{18}F-SSTR PET/CT 与 ^{68}Ga 标记显像原理、诊断效能相当，优势为 ^{18}F 核素半衰期更长。^{18}F-FDG PET/CT 通常用于分化较差、恶性程度较高或生长抑素显像阴性的肿瘤。其对高级别 NETs 的检测灵敏度超过 90%，但在低级别 NETs 中也有 40%~60%的检出率[31]，更适合在国内基层医院推广，可作为 ^{68}Ga-SSTR PET/CT 的首选替代方案。^{111}In-喷曲肽 SPECT/CT 是 SSTR 靶向显像的经典方案，也是 ^{68}Ga-SSTR PET/CT 普及前 EAS 定位的标准功能检查。受核素亲和力、空间分辨率限制，其对 EAS 病灶的总体检出灵敏度仅约 49% [32]，对微小隐匿性病灶的检出能力有限，目前已不作为一线推荐，仅用于无 PET/CT 设备的医疗机构，作为 EAS 初筛的替代检查手段。

3.2. 大剂量地塞米松抑制试验

根据 2025 年《库欣病诊治专家共识》，大剂量地塞米松抑制试验(high-dose dexamethasone-suppression test, HDDST)是推荐临床常规用于 CD 与 EAS 鉴别诊断的一线检查[33]。其核心原理基于 CD 患者的 HPA 轴仍保留部分糖皮质激素负反馈调节功能，服用大剂量地塞米松后可抑制垂体 ACTH 的分泌，进而使外周血皮质醇水平出现显著下降；而 EAS 患者的异位 ACTH 分泌多为自主性，不受糖皮质激素负反馈调控，因此血皮质醇水平无明显抑制。然而其临床应用价值存在较大的地域与学术争议。现有临床数据显示其诊断效能有限，HDDST 对 CD 的敏感性约为 60%~80% [34] [35]，约 20%的 CD 患者对大剂量地塞米松无明显抑制反应，而部分分化程度较好的支气管类癌等神经内分泌肿瘤所致的 EAS，可出现皮质醇假性抑制[36]，易导致鉴别误诊；另外，外源性大剂量糖皮质激素的摄入，可进一步加重患者原有的血糖、血压失控等代谢紊乱，加重低钾血症等电解质异常，同时抑制机体免疫功能，显著增加感染发生风险，对于合并严重并发症的重症 CS 患者，临床应用受限。

3.3. 促肾上腺皮质激素释放激素兴奋试验

促肾上腺皮质激素释放激素(corticotropin releasing hormone, CRH)兴奋试验是国外最常用的非侵入性检测方法[7]。阳性结果为 ACTH 比基线升高 35%~50%，皮质醇升高 14%~20%，提示为库欣病，反之则为异位 ACTH 综合征[37]；CRH 兴奋试验的灵敏度为 76%~91%，特异性为 95%，相较于 HDDST，该方法对于库欣病有良好的诊断价值[34] [35]，但国内尚无 CRH 试剂生产，国外进口试剂价格昂贵，因此未能广泛应用。

3.4. 1-脱氨-8-精氨酸血管升压素兴奋试验

1-脱氨-8-精氨酸血管升压素(1-deamino-8-D-arginine vasopressin, DDAVP)兴奋试验是 CRH 兴奋试验的替代试验，但敏感性及特异性均较 CRH 兴奋试验低[36]。具体方法同 CRH 兴奋试验。应用 DDAVP 后

血皮质醇升高 ≥20%，血 ACTH 升高 ≥35%则判断为阳性，提示为库欣病。一项荟萃分析显示，其灵敏度与 CRH 试验大致相近，但特异度欠佳，在 EAS 患者中可出现较多阳性结果[38]。

3.5. 双侧岩下窦采血

双侧岩下窦采血(bilateral inferior petrosal sinus sampling, BIPSS)是公认的鉴别库欣病与 EAS 的金标准，其敏感性和特异性约为 95% [7] [39] [40]。一项纳入 23 项研究，涉及 1642 名患者的荟萃分析[41]显示，BIPSS 的敏感性为 94%，特异性为 89%。计算下窦/外围窦(IPS/P) ACTH 比值来区分 CD 库欣病和异位 ACTH 综合征。一般来说，CRH 刺激试验前 IPS/P ACTH 比值 ≥2，CRH 测试后 IPS/P ACTH 比值 ≥3 是诊断 CD 的标准[42] [43]。因分泌 ACTH 的肿瘤表面存在加压素受体，且加压素的给药会刺激 ACTH 的释放[44]，在 BIPSS 期间施用 DDAVP 可提升诊断准确性[45]。联合 CRH 兴奋试验可进一步放大梯度差异，提升诊断效能，诊断 CD 的灵敏度与特异度接近 100% [41]。然而 BIPSS 是一种有创的侵入性检查，需经股静脉穿刺置管，将导管送至双侧岩下窦完成采血，操作过程中存在血管损伤、出血、静脉血栓形成、脑神经麻痹等并发症风险，严重者可诱发脑卒中[43] [46] [47]；对于存在岩下窦静脉解剖变异的患者，或垂体微腺瘤位于垂体侧翼、静脉引流不对称时，可出现 ACTH 梯度假阴性结果，进而导致误诊；对操作平台与术者的介入技术要求极高，需具备成熟的神经介入诊疗团队与完善的硬件设施，仅国内少数大型三甲医院可常规开展，基层医院与多数地市级医院均无法完成，地域可及性差，并且医疗成本高昂，无法作为一线筛查手段在临床常规推广。

4. 特殊类型高皮质醇血症的诊断困境与对策

4.1. 周期性库欣综合征

周期性库欣综合征是库欣综合征的特殊亚型，在 CS 中占 18%，特征为皮质醇过量反复出现高峰，随后伴随正常或低皮质醇分泌的低谷期。由于周期时长从数天到数年不等，若在低谷期检测易出现假阴性，导致诊断延误[48] [49]。内分泌学会实践指南建议，对于怀疑周期性库欣综合征的患者，应优先检测 UFC 和 LNSC，而非地塞米松抑制试验[50]。推荐对可疑患者进行每周 1 次 LNSC、每 2 周 1 次 UFC 的连续监测，持续至少 4~6 周，长周期可疑者延长至 3~6 个月。皮质醇通过毛细血管扩散进入毛发细胞，皮肤汗腺可将皮质醇转化为皮质酮，其对库欣综合征的诊断效能与 UFC 相当[51] [52]。头发生长速度约 1 cm/月，对毛发连续 1 cm 分段检测皮质醇，可明确周期性库欣综合征患者的皮质醇暴露时间线，为长周期患者提供补充诊断依据，但目前尚未常规开展[53]。

4.2. 非肿瘤性高皮质醇血症

非肿瘤性高皮质醇血症(non-neoplastic hypercortisolism, NNH)，曾被称为“假性库欣综合征”，其核心机制为下丘脑通过神经通路过度分泌 CRH 和/或精氨酸加压素，刺激正常垂体促肾上腺皮质细胞分泌 ACTH，导致轻中度高皮质醇血症。目前尚无诊断 NNH 的金标准，UFC、LNSC 和 LDDST 在 NNH 患者中也可出现阳性结果，无法区分 CS 与 NNH [7]。对于 UFC 中度升高患者，首要步骤是详细采集病史，尤其是神经精神状态和酒精滥用史。地塞米松(Dexamethasone, DEX)-CRH 试验是目前灵敏度最高的鉴别试验，其灵敏度为 91%、特异度为 82%，诊断比值比达 146.7，但受到全球 CRH 药物短缺限制无法常规检测[10]；DDAVP 试验的灵敏度为 86%、特异度为 90%，已成为 DEX-CRH 试验的首选替代方案[10]。Hinojosa Amaya 等[10]首次对午夜血清皮质醇水平进行了研究，并明确指出，午夜血清皮质醇水平检测可作为 DEX-CRH 试验的有效替代方法，其灵敏度(91%)与 DEX-CRH 试验相当，特异度(81% vs 82%)也相近，建议将 DDAVP 试验和午夜血清皮质醇水平检测作为 DEX-CRH 试验的二线动态替代检测方法。

4.3. 特殊人群库欣综合征

4.3.1. 妊娠期库欣综合征

库欣综合征与正常妊娠存在许多重叠的临床表现，如体重增加、过度疲劳、腹部条纹、外周水肿和情绪波动，高血压、糖耐量异常或妊娠期糖尿病在正常妊娠中也常被诊断，难以有效区分 CS 和正常妊娠。Dong 等人[54]提出，出现高血压、皮肤瘀斑和肌肉萎缩三联征时临床医生应高度怀疑妊娠期库欣综合征。生理状态下胎盘自妊娠 7 周起分泌 CRH 并形成皮质醇-CRH 正反馈，妊娠早期孕妇的 UFC 水平与非妊娠人群相似，妊娠中晚期只有当 UFC 超过非妊娠人群正常上限的 2~3 倍时，才具有诊断价值[55]。部分学者认为 LNSC 是妊娠期 CS 更好的诊断工具，因为尽管妊娠期午夜皮质醇较健康对照组轻度升高，但皮质醇的昼夜节律仍基本保留[55] [56]。目前尚无统一的妊娠期 LNSC 诊断阈值，部分研究建议使用与非妊娠女性相同的阈值[57]；另一些研究则提出了孕期特异性上限：妊娠早期 6.9 nmol/L，妊娠中期 7.2 nmol/L，妊娠晚期 9.1 nmol/L [58]。由于健康孕妇的假阳性率高达 80%，不推荐将 LDDST 用于妊娠期 CS 的诊断[59] [60]。

4.3.2. 老年库欣综合征

老年 CS 患者常缺乏向心性肥胖、紫纹等典型体征，反而以衰弱、肌少症、认知功能减退、反复骨质疏松骨折、难治性高血压和糖尿病等老年常见慢性病为主要表现，造成严重的诊断延迟。一项研究显示，UFC/肌酐比值在 50 岁后随年龄增加逐渐升高[61]。此外，一项评估健康老年人皮质醇激发反应是否异常的荟萃分析显示，与年轻人相比，老年人对刺激的反应性更高，抑制试验后的抑制程度更低[62]。推荐优先采用 LNSC 作为初筛手段，其不受肾功能影响且操作简便，但老年患者是否需提高诊断阈值存在争议[63] [64]。

5. 库欣综合征新型诊断方法

CS 传统诊断流程需联合多项生化检测、诊断试验与影像学检查，流程复杂、耗时较长，易出现漏诊与误诊。基于传统诊断方式的不足，近年来无创性鉴别标志物的研究成为热点。

Lavoillotte 等[65]的回顾性分析显示，尿游离皮质醇鉴别库欣病与异位 ACTH 综合征的效能极佳。可根据尿游离皮质醇升高倍数将患者分为三组：<正常上限 3 倍(组 1)、3~10 倍(组 2)、>10 倍(组 3)，三组对应的异位 ACTH 综合征患病率分别为 0%、2.7%~6.2%、67.4%~73.7%。基于真实世界中额外检测的诊断效能分析，Lavoillotte 等建议：组 1 和组 2 患者先行垂体 MRI，MRI 阴性者再行 CT；组 3 患者先行 CT，CT 阴性者再行垂体 MRI，无需额外进行功能诊断试验。组 2 和组 3 患者影像学检测阴性时，可行 BIPSS。该分层方法可用于制定个体化、简化的检测流程，快速识别高危的异位促肾上腺皮质激素分泌综合征患者。

ACTH 前体物质的测定可能是未来一个有价值的鉴别试验。ACTH 来源于 31-kDa 的前体分子 POMC，在异位 ACTH 综合征中，由于肿瘤细胞对 POMC 的加工障碍，导致血浆中 POMC 水平显著积聚[66]-[68]。Oliver 等[69]前瞻性比较了 POMC 水平与 BIPSS 的诊断价值，报告了 POMC 的高敏感性和特异性。相似地，Page-Wilson 等[70]的研究也显示了 POMC 升高对于诊断 EAS 的高特异性。然而，Raffin-Sanson 等[67]和 Page-Wilson 等[70]认为 POMC 的诊断价值有限，在最常见的隐匿性异位 ACTH 综合征即支气管类癌中，POMC 水平无法检出，其原因是一些支气管类癌肿瘤经历的分化过程与正常皮质促成细胞相似，能有效处理 POMC [71]，而一些具有高度侵袭性的垂体大腺瘤反而 POMC 水平的升高。刺鼠相关蛋白(Agouti-Related Protein, AgRP)在小细胞肺癌异位 ACTH 综合征病例中水平显著升高，以 280 pg/mL 作为诊断阈值时，可独立识别出 10 例异位 ACTH 综合征病例中的 3 例，对诊断 EAS 有一定价值[70]。AgRP

和 POMC 联合用作诊断标志时，其敏感度为 82%，特异度为 100% [70]。

类固醇代谢组学与多组学技术是库欣综合征诊断的未来方向，有望突破现有检测局限。类固醇代谢组学是指质谱法类固醇谱分析联合机器学习数据分析的技术。有研究者认为，通过单次血浆标本检测选定的类固醇谱，可同时完成库欣综合征的诊断与亚型鉴别，效能等同于唾液皮质醇、尿游离皮质醇检测、地塞米松抑制试验及血浆促肾上腺皮质激素检测的联合应用[72]-[74]，未来有望极大简化 CS 的诊断流程。整合基因组学、转录组学、蛋白质组学、代谢组学的多组学技术，是进一步的技术突破，也可为库欣综合征的诊断提供创新的分子检测方法。此外，循环微小 RNA (miRNA)、甲基化标志物等新型分子标志物的研究也取得了重要进展，特定的循环 miRNA 可有效区分 CS 与假性库欣综合征、鉴别 CD 与 EAS，还可预测 CD 患者术后复发风险，是极具临床潜力的无创性生物标志物。但目前此类新型标志物的研究多为小样本单中心研究，其诊断效能仍需大样本多中心研究验证，距离临床常规应用仍有一定距离。

6. 结论

库欣综合征的诊断检测方式各有优劣，无绝对金标准，临床医师需精准把握各类检测的适用场景，结合临床表现与影像学检查，构建个体化诊断体系，最终实现疾病的早筛、早诊、早治。

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