

中华生殖与避孕杂志[®]

原刊名《生殖与避孕》

CHINESE JOURNAL OF REPRODUCTION AND CONTRACEPTION

月刊 1980年12月创刊 第45卷 第10期 2025年10月25日出版



官方微信

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中国科学技术协会

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中华医学会
上海市生物医药技术研究院
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100710,北京市东四西大街42号
电话(传真):(010)51322059
Email:office@cmaph.org

印 刷

上海界龙中报印务有限公司

发 行

范围:公开
国内:中国邮政集团公司
上海分公司
国外:中国国际图书贸易集团
责任有限公司
(北京399信箱,100048)
代号 BM 389

订 购

全国各地邮政局
邮发代号4-928

邮 购

中华生殖与避孕杂志编辑部
200237,上海市老沪闵路779号
电话:(021)64438169,64438975
Email:rande@sibpt.cn

定 价

每期35.00元,全年420.00元

中国标准连续出版物号

ISSN 2096-2916

CN 10-1441/R

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本期责任编辑 乔杰 本期责任编辑 王李艳 本期责任编辑 年丽红

CHINESE JOURNAL OF REPRODUCTION AND CONTRACEPTION

(Original title: *Reproduction and Contraception*)

Monthly

Established in December 1980

Volume 45, Number 10

October 25, 2025



Responsible Institution

China Association for Science and Technology

Sponsor

Chinese Medical Association,
Shanghai Institute for Biomedical and Pharmaceutical Technologies,
Obstetrics and Gynecology Hospital of Fudan University

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779 Laohumin Road, Shanghai 200237, China
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Chinese Medical Journals
Publishing House Co., Ltd.
42 Dongsi Xidajie, Beijing 100710, China
Tel(Fax): 0086-10-51322059
Email: office@cmaph.org

Printing

Shanghai Jielong Zhongbao Printing Co., Ltd

Overseas Distributor

China International Book
Trading Corporation
P.O. Box 399, Beijing 100048, China
Code No.M389

Mail-Order

Editorial Board of Chinese Journal of Reproduction and Contraception
779 Laohumin Road, Shanghai 200237, China
Tel: 0086-21-64438169
Fax: 0086-21-64438975
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CSSN

ISSN 2096-2916
CN 10-1441/R

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DOI: 10.3760/cmaj.cn101441-20250723-00307

收稿日期 2025-07-23 本文编辑 李天琦

引用本文: 中国医师协会生殖医学专业委员会. 中国辅助生殖技术治疗中不同来源精子的采集与处理临床实践指南 (2025 年) [J]. 中华生殖与避孕杂志, 2025, 45(10): 973-984. DOI: 10.3760/cmaj.cn101441-20250723-00307.

中国辅助生殖技术治疗中不同来源 精子的采集与处理临床实践指南 (2025 年)

中国医师协会生殖医学专业委员会

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【摘要】 人类辅助生殖技术的迅速发展, 为不孕不育夫妇带来了生育的希望。精液的采集和实验室优化处理是辅助生殖技术治疗过程中重要的环节。目前, 就精子采集、精子来源的选择、优化处理等诸多环节仍未达成统一意见。针对以上问题, 通过查阅文献与专家讨论, 形成本指南, 旨在为临床实际工作提供参考。

【关键词】 生殖技术, 辅助; 精子来源; 采集; 处理; 指南

基金项目: 国家重点研发计划 (2024YFC2706900、2023YFC2705700、2023YFC2705503)

实践指南注册: 国际实践指南注册与透明化平台, PREPARE-2025CN784

Guidelines on the clinical practice of collecting and processing sperm from diverse sources for assisted reproductive technology in China (2025)

Reproductive Medicine Professional Committee of Chinese Medical Doctor Association

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【 Abstract 】 The rapid development of human assisted reproductive technology (ART) has brought hope of parenthood to infertile couples. Semen collection and laboratory optimization are crucial steps in the ART treatment process. Currently, there is still no unified consensus on many aspects, including sperm collection, selection of sperm sources, optimization processing, and other related procedures. Based on the above issue, this guideline was developed through literature review and expert discussions, with the aim of providing references for clinical practice.

【 Key words 】 Reproductive technology, assisted; Sperm source; Collection; Processing; Guideline

Fund program: National Key Research and Development Program of China (2024YFC2706900, 2023YFC2705700, 2023YFC2705503)

Practice guideline registration: Practice Guideline REgistration for transPAREncy, PREPARE-2025CN784

· 规范与标准 ·

DOI: 10.3760/cma.j.cn101441-20250612-00264

收稿日期 2025-06-12 本文编辑 王李艳

引用本文: 引用格式:中国医师协会生殖医学专业委员会生殖男科学组. 非梗阻性无精子症病因及诊断专家共识(2025 年)[J]. 中华生殖与避孕杂志, 2025, 45(10): 985-1002. DOI: 10.3760/cma.j.cn101441-20250612-00264.

非梗阻性无精子症病因及诊断专家 共识（2025 年）

中国医师协会生殖医学专业委员会生殖男科学组

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【摘要】 非梗阻性无精子症（non-obstructive azoospermia, NOA）病因复杂且多样，包括遗传、内分泌、发育异常、环境暴露及特发性等因素。目前 NOA 病因分类及诊断尚未建立标准化统一流程与路径。对 NOA 进行准确的病因分类及诊断是个体化精准治疗的基础与关键。为此，依托中国医师协会生殖医学专业委员会生殖男科学组，组建了 NOA 病因及诊断专家共识编写组，负责制定本共识。共识经国内生殖男科领域专家多轮讨论、审阅与修订。本共识系统性地将 NOA 病因划分为先天性、获得性及特发性三大类，并详细阐述每个病因分类的流行病学、发病机制、诊断流程及要点，旨在为生殖医学从业者提供 NOA 病因分类及诊断评估流程，指导临床开展个体化精准诊疗。

【关键词】 非梗阻性无精子症； 病因分类； 诊断； 专家共识

基金项目：国家自然科学基金面上项目（82471639）

实践指南注册：国际实践指南注册与透明化平台，PREPARE-2025CN713

Expert consensus on the etiology and diagnosis of non-obstructive azoospermia (2025)

Reproductive Andrology Group, Reproductive Medicine Professional Committee of Chinese Medical Doctor Association

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【 Abstract 】 Non-obstructive azoospermia (NOA) is a condition with multifaceted etiologies, encompassing genetic, endocrine, developmental abnormalities, environmental exposures, and idiopathic factors. Currently, there is a lack of standardized and unified classification and diagnosis for NOA. Accurate categorization and diagnosis of NOA are fundamental for tailored and precise treatment. Thus, the China Expert Consensus Compilation Group on the Etiology and Diagnosis of NOA was established under the auspices of the Reproductive Andrology Group of the Reproductive Medicine Professional Committee of Chinese Medical Doctor Association to develop this consensus. This consensus underwent multiple rounds of discussion, review, and revision by domestic experts in reproductive andrology. The consensus systematically classifies NOA etiologies into congenital, acquired, and idiopathic categories, detailing the epidemiology, pathogenesis, diagnostic procedures, and key considerations for each classification. The aim is to offer reproductive medicine practitioners a framework for NOA etiological classification and diagnostic assessment, guiding personalized and accurate clinical diagnosis and treatment.

【 Key words 】 Non-obstructive azoospermia; Etiological classification; Diagnosis; Expert consensus

Fund program: General Program of National Natural Science Foundation of China (82471639)

Practice guideline registration: Practice Guideline REgistration for transPAREncy, PREPARE-2025CN713

DOI: 10.3760/cmaj.cn101441-20250519-00234

收稿日期 2025-05-19 本文编辑 王李艳

引用本文: 中国医师协会生殖医学专业委员会生殖男科学组,精子功能检测专家共识编写组. 精子功能检测专家共识(2025年)[J]. 中华生殖与避孕杂志, 2025, 45(10): 1003-1012. DOI: 10.3760/cmaj.cn101441-20250519-00234.

精子功能检测专家共识 (2025年)

中国医师协会生殖医学专业委员会生殖男科学组 精子功能检测专家共识编写组

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【摘要】 精子功能检测对精子质量评估有着重要意义, 精子功能异常不仅是男性不育症及不良妊娠的重要因素, 还可以影响辅助生殖技术的临床结局。临床实践中, 医生以及实验室工作人员对此类检测的认识存在不足, 相关检测类型、适应证及技术手段等方面仍存在争议。本共识由中国医师协会生殖医学专业委员会生殖男科学组组织权威专家编写, 深入分析近年来国内外精子功能检测的相关文献和指南, 并结合中国专家在此领域的经验, 形成此共识, 以期从事男科学、生殖医学等相关领域的临床医务人员提供专家建议, 并为从事生殖生物学特别是精子功能研究的科研工作者提供借鉴。

【关键词】 不育, 男性; 精子功能测定; 生殖男科学; 生殖技术, 辅助; 专家共识

基金项目: 国家重点研发计划(2023YFC2705503); 上海市 2024 年度“科技创新行动计划”医学创新研究专项(24Y12800700、24Y12800703)

实践指南注册: 国际实践指南注册与透明化平台, PREPARE-2025CN507

Expert consensus on sperm function testing (2025)

Expert Consensus Compilation Group for Sperm Function Testing; Reproductive Andrology Group, Reproductive Medicine Professional Committee of Chinese Medical Doctor Association

Corresponding authors: Chen Xiangfeng, Department of Reproductive Medicine, Ren Ji Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai 200135, China, Email: allanbacon@163.com; Xiong Chengliang, Reproductive Medicine Center of Tongji Medical College, Huazhong University of Science and Technology, Wuhan 430030, China, Email: clxiong951@sina.com

【Abstract】 Sperm function testing is of great significance for evaluating sperm quality. Abnormal sperm function is not only an important factor in male infertility and adverse pregnancy outcomes, but also can affect the clinical outcomes of assisted reproductive technology. In clinical practice, doctors and laboratorians still have insufficient understanding of sperm function testing, and there are still controversies regarding the types, indications, and technical methods of related testing. This consensus was compiled by authoritative experts organized by the Reproductive Andrology Group of the Reproductive Medicine Professional Committee of Chinese Medical Doctor Association. It deeply analyzes the relevant literature and guidelines on sperm function testing in recent years, and combines the experience of Chinese experts in this field, in order to provide expert advice for clinical medical personnel engaged in andrology, reproductive medicine and other related fields, and to provide reference for researchers engaged in reproductive biology, especially in sperm function researches.

【Key words】 Infertility, male; Sperm function testing; Reproductive andrology; Reproductive technology, assisted; Expert consensus

Fund programs: National Key R&D Program of China (2023YFC2705503); Shanghai 2024 "Science and Technology Innovation Action Plan" Medical Innovation Research Project (24Y12800700, 24Y12800703)

Practice guideline registration: Practice Guideline REgistration for transPAREncy, PREPARE-2025CN507

• 规范与标准 •

DOI: 10.3760/cmaj.cn101441-20250804-00322

收稿日期 2025-08-04 本文编辑 宋培培

引用本文: 引用格式:中国医师协会生殖医学专业委员会生殖男科学组, 生殖道感染对男性生育力的影响及干预专家共识编写组. 生殖道感染对男性生育力的影响及干预专家共识(2025年)[J]. 中华生殖与避孕杂志, 2025, 45(10): 1013-1025. DOI: 10.3760/cmaj.cn101441-20250804-00322.

生殖道感染对男性生育力的影响及 干预专家共识(2025年)

中国医师协会生殖医学专业委员会生殖男科学组 生殖道感染对男性生育力的影响及干预专家共识编写组

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【摘要】 全球 8%~12% 不孕不育夫妇中男性病因占比近 50%，而男性生殖道感染（male genital tract infections, MGTIs）是男性不育的重要病因之一。本共识基于循证医学证据整合相关领域专家意见，系统阐述病原体对精液参数、生育功能及辅助生殖结局的影响机制，并提出诊疗路径。核心内容强调：多种病原体可通过不同途径损害男性生育力，如细菌感染易引发附睾炎及梗阻性病变；沙眼衣原体通过脂多糖直接损伤精子活力与 DNA 完整性；病毒类病原体通过黏附精子诱发氧化应激，显著增加 DNA 碎片指数；腮腺炎病毒可致睾丸萎缩，但显微取精仍可获取临床可用有效精子。鉴于无症状感染比例高，推荐采用高灵敏度分子检测技术并规范采样流程。治疗需依据病原体特性选择敏感抗生素，急性感染期暂缓辅助生殖；对支原体等争议性感染建议个体化评估。辅助生殖实施中需重点关注风险管控：人类免疫缺陷病毒 / 乙肝病毒感染者应结合精子洗涤技术，人乳头瘤病毒、寨卡病毒等可经精子载体垂直传播，需严格筛查。预防策略包括包皮环切术、疫苗接种及性伴侣同步治疗。本共识为 MGTIs 临床识别、干预及生育力保护提供关键指导，以改善夫妇的妊娠结局。

【关键词】 生殖道感染； 病原体； 男性生育力； 治疗； 专家共识
基金项目：国家重点研发计划（2023YFC2705503）
实践指南注册：国际实践指南注册与透明化平台，PREPARE-2025CN1101

Expert consensus on the impact and intervention of reproductive tract infections on male fertility (2025)

Expert Consensus Compilation Group for Reproductive Tract Infections Impact and Intervention; Reproductive Andrology Group, Reproductive Medicine Professional Committee of Chinese Medical Doctor Association

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【Abstract】 Male factors account for approximately 50% of infertility cases affecting 8%–12% of couples globally, with male genital tract infections (MGTIs) representing a significant etiological factor in male infertility. This consensus, integrating expert opinions based on evidence-based medicine, systematically elucidates the mechanisms by which pathogens impair semen parameters, reproductive function, and assisted reproductive technology (ART) outcomes, and proposes a diagnostic and therapeutic pathway. Key points emphasize that diverse pathogens impair male fertility through distinct pathways: bacterial infections

frequently cause epididymitis and obstructive lesions; *Chlamydia trachomatis* directly damages sperm motility and DNA integrity via lipopolysaccharides; viral pathogens adhere to spermatozoa, inducing oxidative stress and significantly increasing DNA fragmentation index; while mumps virus may cause testicular atrophy, viable sperm could still be retrieved via microsurgical sperm extraction. Given the high prevalence of asymptomatic infections, high-sensitivity molecular diagnostic techniques and standardized sample collection protocols are recommended. Treatment requires selecting sensitive antibiotics based on pathogen characteristics, with ART deferred during acute infection; individualized assessment is advised for infections with debated clinical significance (e.g., *Mycoplasma* spp.). ART implementation necessitates stringent risk management: sperm washing techniques should be integrated for human immunodeficiency virus/hepatitis B virus-infected individuals, and rigorous screening is mandated for pathogens posing vertical transmission risks via sperm vectors (e.g., human papillomavirus, Zika virus, etc). Prevention strategies include circumcision, vaccination programs, and synchronous treatment of sexual partners. This consensus provides critical guidance for the clinical identification, management of MGTIs, and fertility preservation, aiming to improve pregnancy outcomes.

【Key words】 Genital tract infections; Pathogens; Male fertility; Therapy; Expert consensus

Fund program: National Key R&D Program of China (2023YFC2705503)

Practice guideline registration: Practice Guideline REgistration for transPAREncy, PREPARE-2025CN1101

· 临床研究 ·

DOI: 10.3760/cmaj.cn101441-20250408-00173

收稿日期 2025-04-08 本文编辑 宋培培

引用本文: 张印峰, 黄澳淼, 王昕妍, 等. 扳机日血清孕酮水平对拮抗剂方案 IVF/ICSI-ET 助孕结局的影响 [J]. 中华生殖与避孕杂志, 2025, 45(10): 1026-1031. DOI: 10.3760/cmaj.cn101441-20250408-00173.

扳机日血清孕酮水平对拮抗剂方案 IVF/ICSI-ET 助孕结局的影响

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【摘要】 目的 确定促性腺激素释放激素 (gonadotropin-releasing hormone, GnRH) 拮抗剂方案中扳机日孕酮水平的最佳阈值。方法 采用回顾性队列研究方法,分析 2014 年 1 月至 2023 年 5 月于天津市中心妇产科医院生殖医学中心行体外受精/卵胞质内单精子注射 (*in vitro* fertilization/intracytoplasmic sperm injection, IVF/ICSI) 助孕治疗的 5 760 个 GnRH 拮抗剂方案新鲜移植周期的临床资料。本研究为单臂研究,临床妊娠率和活产率为主要结局指标。采用限制性立方样条分析扳机日孕酮水平和临床妊娠结局的关联性 & 剂量-反应关系。结果 扳机日孕酮水平为 $(1.33 \pm 0.38) \mu\text{g/L}$, 其中 2 900 个周期进行常规 IVF 授精, 2 860 个周期进行 ICSI 授精, 生化妊娠率为 44.79% (2 580/5 760), 临床妊娠率为 40.35% (2 324/5 760), 活产率为 31.46% (1 812/5 760)。GnRH 拮抗剂方案扳机日孕酮水平与临床妊娠率及活产率均呈非线性关联 (均 $P < 0.001$): 当孕酮水平 $< 0.61 \mu\text{g/L}$ 时, 临床妊娠率随孕酮水平升高而增加, 超过此阈值则显著降低; 活产率在孕酮水平 $< 0.63 \mu\text{g/L}$ 时随孕酮水平升高而增加, 超过后亦降低。结论 GnRH 拮抗剂方案中, 扳机日孕酮水平为 $0.61 \mu\text{g/L}$ 和 $0.63 \mu\text{g/L}$ 时, 临床妊娠率及活产率分别达到峰值, 扳机日孕酮水平对妊娠结局的影响呈现先促进后抑制的双向趋势。

【关键词】 孕酮; 拮抗剂方案; 临床妊娠率; 活产率

基金项目: 天津市中心妇产科医院/天津市人类发育与生殖调控重点实验室开放基金 (2022XH09); 天津市医学重点学科建设资助 (TJYXZDXK-3-029C)

Impact of serum progesterone levels on the trigger day on IVF/ICSI-ET outcomes in antagonist protocols

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【Abstract】 Objective To determine the optimal threshold for trigger-day progesterone levels in gonadotropin-releasing hormone (GnRH) antagonist protocols. **Methods** A cohort study was performed. The clinical data were retrospectively analyzed from patients who underwent *in vitro* fertilization/intracytoplasmic sperm injection (IVF/ICSI) for assisted reproduction at the Reproductive Medicine Center of Tianjin Central Obstetrics and Gynecology Hospital between January 2014 and May 2023. The study included 5 760 fresh transfer cycles where the female partner had undergone ovarian stimulation using a

GnRH antagonist protocol. This was a single-arm study. The primary outcome measures were clinical pregnancy rate and live birth rate. The association between progesterone level on the trigger day and clinical pregnancy outcome and the dose-response relationship were analyzed by restricted cubic spline. **Results** The progesterone level on the day of human chorionic gonadotropin trigger was (1.33 ± 0.38) $\mu\text{g/L}$. Among the included cycles, 2 900 cycles underwent conventional IVF fertilization, while 2 860 cycles underwent ICSI. The biochemical pregnancy rate was 44.79% (2 580/5 760), the clinical pregnancy rate was 40.35% (2 324/5 760), and the live birth rate was 31.46% (1 812/5 760). Progesterone levels on the trigger day in GnRH antagonist protocols showed a nonlinear association with both clinical pregnancy rate and live birth rate (both $P<0.001$). When progesterone levels were below 0.61 $\mu\text{g/L}$, the clinical pregnancy rate increased with rising progesterone levels, but decreased significantly once this threshold was exceeded. Similarly, the live birth rate increased with progesterone levels below 0.63 $\mu\text{g/L}$ and declined beyond that point. **Conclusion** Progesterone levels on the optimal trigger day for achieving the highest clinical pregnancy rate and live birth rate in GnRH antagonist protocols are peak values of 0.61 $\mu\text{g/L}$ and 0.63 $\mu\text{g/L}$, respectively. Using these thresholds, the impact of progesterone levels on the trigger day shows a positive effect on both clinical pregnancy rate and live birth rate up to these points, after which the effects become negative.

【Key words】 Progesterone; Antagonist protocol; Clinical pregnancy rate; Live birth rate

Fund program: Open Fund of Tianjin Central Hospital of Gynecology Obstetrics/Tianjin Key Laboratory of Human Development and Reproductive Regulation (2022XH09); Tianjin Key Medical Discipline Construction Project (TJYXZDXK-3-029C)

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DOI: 10.3760/cmaj.cn101441-20250321-00135

收稿日期 2025-03-21 本文编辑 王李艳

引用本文: 范蒙洁, 王丽颖, 张华, 等. 宫腔镜手术改善超声诊断 FIGO II、III型子宫肌瘤患者新鲜胚胎移植助孕结局[J]. 中华生殖与避孕杂志, 2025, 45(10): 1032-1037. DOI: 10.3760/cmaj.cn101441-20250321-00135.

宫腔镜手术改善超声诊断 FIGO

II、III型子宫肌瘤患者新鲜胚胎移

植助孕结局

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【摘要】 目的 探讨宫腔镜手术对超声诊断 FIGO II、III型子宫肌瘤患者新鲜胚胎移植助孕结局的影响，为临床提供参考依据。方法 采用回顾性队列研究，分析 2020 年 1 月至 2022 年 12 月于北京大学第三医院妇产科生殖医学中心就诊、经阴道超声提示子宫肌瘤贴近或凸向宫腔（FIGO II、III型）且行新鲜胚胎移植助孕的 346 例患者临床资料，根据是否行宫腔镜手术将患者分为宫腔镜手术组（ $n=237$ ，即行宫腔镜后再行胚胎移植组）和未做手术组（ $n=109$ ，即未做宫腔镜直接行胚胎移植组）。比较两组患者的基本资料及胚胎移植妊娠结局，采用多因素 logistic 回归分析影响临床妊娠率及活产率的因素。结果 两组患者基本情况差异均无统计学意义（均 $P>0.05$ ）。宫腔镜手术组新鲜胚胎移植的临床妊娠率 [44.3%（105/237）] 及活产率 [32.5%（77/237）] 均显著高于未做手术组 [31.2%（34/109）， $P=0.021$ ；18.3%（20/109）， $P=0.007$]，妊娠丢失率两组间差异无统计学意义（ $P>0.05$ ）。根据年龄进行分层分析，结果显示，对于年龄 <35 岁的患者，宫腔镜手术组新鲜胚胎移植周期临床妊娠率 [62.1%（54/87）] 及活产率 [51.7%（45/87）] 显著高于未做手术组 [30.8%（12/39）， $P=0.001$ ；25.6%（10/39）， $P=0.006$]。多因素 logistic 回归分析结果显示，宫腔镜手术是其临床妊娠率（ $OR=4.222$ ，95% CI : 1.745~10.215， $P=0.001$ ）及活产率（ $OR=3.449$ ，95% CI : 1.436~8.282， $P=0.006$ ）的影响因素。结论 若不孕患者超声提示子宫肌瘤贴近或凸向宫腔，尤其是年轻患者，建议积极行宫腔镜手术，可改善新鲜胚胎移植妊娠结局，提高临床妊娠率及活产率。

【关键词】 宫腔镜； 妊娠结局； 子宫肌瘤； 新鲜胚胎移植

基金项目：国家重点研发项目（2022YFA1104801）；国家杰出青年科学基金（81925013）；国家临床重点专科建设项目（2023）专项基金

Hysteroscopy improves the pregnancy outcomes following fresh embryo transfer in patients with FIGO Type II and III uterine fibroids diagnosed by ultrasound

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【Abstract】 Objective To investigate the impact of hysteroscopic surgery on fresh embryo transfer outcomes in patients with transvaginal ultrasound-diagnosed FIGO Type II/III uterine fibroids that may affect the uterine cavity morphology, providing a reference for clinical practice. **Methods** A retrospective cohort study was performed to analyze the clinical data of 346 patients who visited the Reproductive Medicine Center, Department of Obstetrics and Gynecology, Peking University Third Hospital between January 2020 and December 2022, with transvaginal ultrasound findings indicating uterine fibroids adjacent to or protruding into the uterine cavity (FIGO Type II, III) and who underwent fresh embryo transfer. Patients were divided into two groups based on whether hysteroscopic surgery were performed: the hysteroscopic surgery group ($n=237$, the group that underwent hysteroscopy before embryo transfer) and the non-surgery group ($n=109$, the group that proceeded directly to embryo transfer without hysteroscopy). Basic patient characteristics and pregnancy outcomes were compared between the two groups. Multivariate logistic regression analysis was used to identify factors influencing clinical pregnancy rate and live birth rate. **Results** The baseline characteristics showed no statistically significant differences between the two groups. The clinical pregnancy rate [44.3% (105/237)] and the live birth rate [32.5% (77/237)] following fresh embryo transfer in the hysteroscopic surgery group were significantly higher than those in the non-surgery group [31.2% (34/109), $P=0.021$; 18.3% (20/109), $P=0.007$], whereas the pregnancy loss rate showed no significant difference. Stratified analysis by age revealed that for patients aged <35 years, the clinical pregnancy rate [62.1% (54/87)] and the live birth rate [51.7% (45/87)] in fresh embryo transfer cycles were significantly higher in the hysteroscopic surgery group compared with the non-surgery group [30.8% (12/39), $P=0.001$; 25.6% (10/39), $P=0.006$]. Multivariate logistic regression analysis further confirmed that hysteroscopic surgery was an independent factor influencing live birth rate ($OR=2.128$, 95% CI : 1.152–3.930, $P=0.016$). Among patients aged <35 years, hysteroscopic surgery was an influencing factor of both clinical pregnancy rate ($OR=4.222$, 95% CI : 1.745–10.215, $P=0.001$) and live birth rate ($OR=3.449$, 95% CI : 1.436–8.282, $P=0.006$). **Conclusion** For infertile patients with ultrasound findings of uterine fibroids adjacent to or protruding into the uterine cavity, especially younger patients, hysteroscopy is recommended. It can improve pregnancy outcomes of fresh embryo transfer, increasing both the clinical pregnancy rate and the live birth rate.

【Key words】 Hysteroscopy; Pregnancy outcomes; Uterine fibroids; Fresh embryo transfer

Fund program: National Key Research and Development Program of China (2022YFA1104801); National Science Fund for Distinguished Young Scholars (81925013); Special Fund for the National Clinical Key Specialty Construction Project (2023)

DOI: 10.3760/cmaj.cn101441-20250512-00225

收稿日期 2025-05-12 本文编辑 王李艳

引用本文: 辛磊, 张雨桐, 刘丽婷, 等. 白藜芦醇通过介导 NRF2 信号通路防止精子冷冻保存中的氧化应激损伤[J]. 中华生殖与避孕杂志, 2025, 45(10): 1038-1046. DOI: 10.3760/cmaj.cn101441-20250512-00225.

50.62±10.10 比 54.36±10.43,

白藜芦醇通过介导 NRF2 信号通路防止精子冷冻保存中的氧化应激损伤

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【摘要】 目的 探讨白藜芦醇 (resveratrol, RSV) 在人精子冷冻保存中的保护效果及其保护机制。方法 收集来自安徽医科大学第一附属医院妇产科生殖医学中心及人类精子库 2022 年 12 月至 2024 年 12 月 165 份正常新鲜精液样本, 其中 65 份用于获取常规冷冻前后的精液参数, 另 104 份每份样本按体积 2:1 分别与含有 0、10⁻⁶、10⁻⁵、10⁻⁴ mol/L RSV 的保护剂混匀后在液氮中冻存 24 h。解冻复苏后再检测精子常规参数; 通过精子染色质扩散实验检测精子 DNA 碎片指数 (DNA fragmentation index, DFI); 通过流式细胞仪检测精子活性氧水平; 通过分子对接分析及细胞热迁移实验 (cellular thermal shift assay, CETSA) 观察 RSV 与核因子红细胞 2 相关因子 (nuclear factor erythroid 2-related factor 2, NRF2) 的相互作用; 通过免疫荧光和 Western blotting 观察 NRF2 含量; 通过 qRT-PCR 观察 *NRF2* 及下游抗氧化蛋白血红素氧合酶 1 (heme oxygenase-1, HO-1)、NAD(P)H: 醌氧化还原酶 1 (NAD(P)H: quinone oxidoreductase 1, NQO1) mRNA 水平; 观察添加 NRF2 抑制剂 ML385 对精子常规参数的影响。结果 与新鲜样本比较, 常规冷冻保存显著降低了精子的运动能力 (均 $P<0.001$)。

与未添加 RSV 冻后组比较, 添加 10^{-6} mol/L RSV 显著增加冻后前向运动精子百分率 ($26.98\% \pm 8.98\%$ 比 $19.61\% \pm 8.03\%$, $P < 0.001$), 降低冻后精子 DFI ($9.84\% \pm 3.81\%$ 比 $15.06\% \pm 4.22\%$, $P < 0.001$) 和活性氧水平 ($P < 0.001$)。分子对接分析和 CETSA 均表明 RSV 可作用于 NRF2, 且添加 10^{-6} mol/L RSV 的冻后精子 NRF2 及下游 HO-1、NQO1 水平均显著高于未添加 RSV 冻后组 (均 $P < 0.001$), 添加 ML385 后 RSV 对冻后精子活力的保护作用明显降低 ($P < 0.001$)。结论 RSV 可能通过 NRF2 发挥抗氧化保护作用, 降低活性氧水平, 进一步提高冻后精子参数和功能。

【关键词】 精子; 冷冻保存; 抗氧化剂; 白藜芦醇; 核因子红细胞 2 相关因子

基金项目: 国家自然科学基金 (82171607); 安徽省高校自然科学研究重点项目 (2023AH053287); 安徽省转化医学研究院项目 (2022zhyyx-C33); 安徽医科大学基础与临床合作研究提升计划 (2023xkjT036)

Resveratrol protects against oxidative stress damage during sperm cryopreservation by mediating the NRF2 signaling pathway

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【Abstract】 **Objective** To investigate the protective effects of resveratrol (RSV) on human sperm cryopreservation and explore its underlying protective mechanisms. **Methods** A total of 165 normal fresh semen samples were collected from the Reproductive Medicine Center, Department of Obstetrics and Gynecology and Human Sperm Bank of the First Affiliated Hospital of Anhui Medical University between December 2022 and December 2024. Among them, 65 samples were used to obtain semen parameters before and after conventional freezing. Each sample of the other 104 samples was mixed at a 2 : 1 volume ratio with cryoprotectant containing 0, 10^{-6} , 10^{-5} , or 10^{-4} mol/L RSV, followed by cryopreservation in liquid nitrogen for 24 h. Post-thaw assessments included routine sperm parameters, sperm DNA fragmentation index (DFI) evaluated by sperm chromatin dispersion assay, reactive oxygen species (ROS) levels measured via flow cytometry, RSV and nuclear factor erythroid 2-related factor 2 (NRF2) interactions examined by molecular docking and cellular thermal shift assay (CETSA), NRF2 protein contents analyzed by immunofluorescence and Western blotting, mRNA levels of NRF2 and downstream antioxidant proteins Heme Oxygenase-1 (HO-1) and NAD(P)H: quinone oxidoreductase 1 (NQO1) quantified by qRT-PCR and effects of NRF2 inhibitor ML385 on sperm parameters. **Results** Compared with fresh samples, conventional cryopreservation significantly reduced sperm motility (all $P < 0.001$). The addition of 10^{-6} mol/L RSV significantly improved the percentage of forward motile sperm after freezing ($26.98\% \pm 8.98\%$ vs. $19.61\% \pm 8.03\%$, $P < 0.001$) while reducing DFI ($9.84\% \pm 3.81\%$ vs. $15.06\% \pm 4.22\%$, $P < 0.001$) and ROS levels ($P < 0.001$) compared

with the post-freezing group without the addition of RSV. Both molecular docking analysis and CETSA confirmed that RSV interacted with NRF2. Notably, sperm cryopreserved with 10^{-6} mol/L RSV exhibited significantly higher contents of NRF2 and its downstream effectors HO-1 and NQO1 compared with the post-freezing group without the addition of RSV (all $P<0.001$). This protective effect was markedly attenuated by co-treatment with the NRF2 inhibitor ML385, as evidenced by a significant decline in sperm motility ($P<0.001$). **Conclusion** RSV exerts cryoprotective effects likely through NRF2-mediated antioxidant pathways, reducing oxidative stress and enhancing post-thaw sperm quality.

【Key words】 Sperm; Cryopreservation; Antioxidant; Resveratrol; Nuclear factor erythroid 2-related factor 2

Fund program: National Natural Science Foundation of China (82171607); Anhui Provincial University Natural Science Research Key Project (2023AH053287); Anhui Provincial Institute of Translational Medicine (2022zhyx-C33); Basic and Clinical Cooperative Research Enhancement Program of Anhui Medical University (2023xkjT036)

· 临床报道 ·

DOI: 10.3760/cmaj.cn101441-20250804-00323

收稿日期 2025-08-04 本文编辑 李天琦

引用本文: 郭湘平, 郑维维. 认知行为疗法在减轻人工流产患者焦虑及促进其术后快速康复中的应用效果[J]. 中华生殖与避孕杂志, 2025, 45(10): 1047-1053. DOI: 10.3760/cmaj.cn101441-20250804-00323.

认知行为疗法在减轻人工流产患者焦虑及促进其术后快速康复中的应用效果

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【摘要】 目的 探讨认知行为疗法对减轻人工流产手术患者焦虑及促进其术后快速康复中的效果。方法 选取 2024 年 1 月至 2025 年 1 月在东阳市妇幼保健院手术室接受人工流产手术的 480 例患者为研究对象, 采用非随机对照试验, 按照纳入顺序依次将患者分配到干预组和对照组, 每组 240 例。对照组采取常规宣教, 干预组在对照组基础上实施认知行为疗法, 以汉密尔顿焦虑量表 (Hamilton anxiety scale, HAMA)、焦虑自评量表 (self-rating anxiety scale, SAS)、生活质量量表 (36-item short-form health survey, SF-36) 评分为主要观测的结局指标。比较两组患者干预后焦虑情绪、术后 24 h 疼痛程度、术后恢复情况、术后

并发症情况，及干预后生活质量变化。以患者基线特征为自变量，HAMA、SAS、SF-36 评分为因变量，进行多元线性回归分析。结果 干预组 HAMA、SAS 评分分别为 (5.76 ± 1.13) 分、 (40.98 ± 3.76) 分，均低于对照组 [(7.08 ± 1.42) 分、 (46.42 ± 4.14) 分]，差异均有统计学意义（均 $P < 0.001$ ）；术后 24 h 干预组视觉疼痛模拟量表（visual analogue scale, VAS）评分 [(1.64 ± 0.48) 分] 低于对照组 [(2.83 ± 0.76) 分]，差异有统计学意义（ $P < 0.001$ ）。干预组阴道流血持续时间、月经复潮时间及日常活动恢复时间 [(8.23 ± 2.36) d、 (28.34 ± 3.65) d、 (18.98 ± 5.24) d] 均短于对照组 [(10.87 ± 2.16) d、 (33.47 ± 4.18) d、 (25.42 ± 4.16) d]，差异均有统计学意义（均 $P < 0.001$ ）。术后 6 周，干预组并发症总发生率为 5.0%（12/240），低于对照组的 12.9%（31/240），差异有统计学意义（ $P = 0.002$ ）。干预后，干预组 SF-36 各维度总评分 [(334.68 ± 5.79) 分] 高于对照组 [(305.46 ± 5.93) 分]，差异有统计学意义（ $P < 0.001$ ）。多元线性回归分析显示，更高的文化程度（本科及以上与初中及以下相比：HAMA $\beta = -0.52$, 95% CI: $-0.85 \sim -0.19$, $P = 0.002$ ；SAS $\beta = -0.75$, 95% CI: $-1.31 \sim -0.19$, $P = 0.008$ ）和更高的家庭收入（HAMA $\beta = -0.15$, 95% CI: $-0.22 \sim -0.08$, $P < 0.001$ ；SAS $\beta = -0.18$, 95% CI: $-0.28 \sim -0.08$, $P < 0.001$ ）是降低焦虑水平的保护因素。已婚是 SAS 评分的保护因素（ $\beta = -0.68$, 95% CI: $-1.22 \sim -0.14$, $P = 0.013$ ），而孕次较多是 SAS 评分的危险因素（ $\beta = 0.19$, 95% CI: $0.07 \sim 0.31$, $P = 0.002$ ）。年龄增长是 HAMA 评分的保护因素（ $\beta = -0.03$, 95% CI: $-0.05 \sim -0.01$, $P = 0.001$ ）。更高的文化程度（大专： $\beta = 3.25$, 95% CI: $0.60 \sim 5.90$, $P = 0.016$ ；本科及以上： $\beta = 5.02$, 95% CI: $2.33 \sim 7.71$, $P < 0.001$ ）、更高的家庭收入（ $\beta = 1.25$, 95% CI: $0.55 \sim 1.95$, $P < 0.001$ ）及已婚状态（ $\beta = 2.81$, 95% CI: $0.28 \sim 5.34$, $P = 0.030$ ）均是生活质量的显著正向预测因素。结论 认知行为疗法可有效缓解人工流产患者的焦虑情绪，减少术后并发症，促进恢复，并提高生活质量。

【关键词】 认知行为疗法； 焦虑； 人工流产手术

Effectiveness of cognitive behavioural therapy in reducing anxiety and promoting rapid postoperative recovery in abortion patients

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【Abstract】 **Objective** To evaluate the effect of cognitive behavioral therapy (CBT) on reducing anxiety and promoting rapid postoperative recovery in patients undergoing induced abortion surgery. **Methods** Non-randomized controlled trials were adopted, a total of 480 patients scheduled for induced abortion between January 2024 and January 2025 were consecutively enrolled and allocated to the intervention group ($n=240$) or control group ($n=240$). The control group received conventional education, whereas the intervention group implemented cognitive behavioral therapy on the basis of control group. The Hamilton anxiety scale (HAMA), the self-rating anxiety scale (SAS) and the 36-item short-form health survey (SF-36) were the main observed outcome measures. The anxiety, pain degree 24 h after the intervention, postoperative recovery, postoperative complications and changes in quality of life after the intervention were compared between the two

groups of patients. Taking the baseline characteristics of the patients as independent variables and the scores of HAMA, SAS and SF-36 as dependent variables, multiple linear regression analysis was conducted. **Results** After the intervention, the scores of HAMA and SAS in the intervention group were 5.76 ± 1.13 and 40.98 ± 3.76 respectively, which were lower than those in control group (7.08 ± 1.42 ; 46.42 ± 4.14), and the differences were statistically significant (all $P < 0.001$). The score of the visual analogue scale 24 h after the operation was lower than that in control group (1.64 ± 0.48 vs. 2.83 ± 0.76), and the difference was statistically significant ($P < 0.001$). The duration of vaginal bleeding, the time of menstrual resumption and the recovery time of daily activities in the intervention group were all shorter than those in control group [(8.23 $\pm$ 2.36) d vs. (10.87 $\pm$ 2.16) d; (28.34 $\pm$ 3.65) d vs. (33.47 $\pm$ 4.18) d; (18.98 $\pm$ 5.24) d vs. (25.42 $\pm$ 4.16) d], and the differences were statistically significant (all $P < 0.001$). Six weeks after the operation, the total incidence of complications in the intervention group was 5.0% (12/240), which was lower than that in control group [12.9% (31/240)], and the difference was statistically significant ($P = 0.002$). After the intervention, the total score of each dimension of SF-36 was higher than that in control group (334.68 ± 5.79 vs. 305.46 ± 5.93), and the difference was statistically significant ($P < 0.001$). Multiple linear regression analysis showed that higher educational attainment (bachelor's degree and above compared with junior high school and below HAMA $\beta = -0.52$, 95% CI: $-0.85 - -0.19$, $P = 0.002$; SAS $\beta = -0.75$, 95% CI: $-1.31 - -0.19$, $P = 0.008$) and higher household income (HAMA $\beta = -0.15$, 95% CI: $-0.22 - -0.08$, $P < 0.001$; SAS $\beta = -0.18$, 95% CI: $-0.28 - -0.08$, $P < 0.001$) were protective factors for reducing anxiety levels. Married was the protection factor in SAS scores ($\beta = -0.68$, 95% CI: $-1.22 - -0.14$, $P = 0.013$), and higher number of pregnancies was a risk factor for SAS scores ($\beta = 0.19$, 95% CI: $0.07 - 0.31$, $P = 0.002$). Age increase was a protective factor for HAMA score ($\beta = -0.03$, 95% CI: $-0.05 - -0.01$, $P = 0.001$). Higher educational attainment (junior college: $\beta = 3.25$, 95% CI: $0.60 - 5.90$, $P = 0.016$; bachelor's degree and above: $\beta = 5.02$, 95% CI: $2.33 - 7.71$, $P < 0.001$), higher household income ($\beta = 1.25$, 95% CI: $0.55 - 1.95$, $P < 0.001$), and married status ($\beta = 2.81$, 95% CI: $0.28 - 5.34$, $P = 0.030$) were all significant positive predictors of quality of life. **Conclusion** Cognitive-behavioral therapy effectively alleviates anxiety, reduces post-operative complications, accelerates recovery, and improves the quality of life in women undergoing induced abortion.

【Key words】 Cognitive behavioral therapy; Anxiety; Abortion surgery

· 个案报道 ·

DOI: 10.3760/cma.j.cn101441-20250425-00203

收稿日期 2025-04-25 本文编辑 宋培培

引用本文: 李艳如, 张慧娟, 崔趁趁, 等. 常染色体显性遗传多囊肾病患者应用第三代测序技术进行 PGT 的 1 例报道[J]. 中华生殖与避孕杂志, 2025, 45(10): 1054-1057. DOI: 10.3760/cma.j.cn101441-20250425-00203.

常染色体显性遗传多囊肾病患者应用第三代测序技术进行 PGT 的 1 例报道

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【摘要】 随着胚胎植入前遗传学检测 (preimplantation genetic testing, PGT) 技术的应用发展, 第三代测序技术在 PGT 中的临床应用需求不断增加。本文报道 1 例常染色体显性遗传多囊肾病患者通过第三代测序技术进行 PGT 后的妊娠结局, 总结第三代测序技术的技术特点, 以及其对新发突变家系进行 PGT 检测具有的显著优势和应用的局限性。

【关键词】 第三代测序技术; 常染色体显性遗传多囊肾病; 植入前遗传学检测

基金项目: 河南省重点研发专项 (251111312200)

A case report of application of third-generation sequencing technology in preimplantation genetic testing for patients with autosomal dominant polycystic kidney disease

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【Abstract】 With the development of preimplantation genetic testing (PGT) technology, the application of third-generation sequencing technology in PGT has been increasing. This article reports the pregnancy outcome of a patient with autosomal dominant polycystic kidney disease who underwent PGT using the third-generation sequencing technology. It summarizes the technical characteristics of third-generation sequencing technology, as well as its significant advantages and limitations in PGT for families with *de novo* mutations.

【Key words】 Third-generation sequencing; Autosomal dominant polycystic kidney disease; Preimplantation genetic testing

Fund program: Henan Province Key Research Special Project (251111312200)

· 专家视角 ·

DOI: 10.3760/cmaj.cn101441-20250415-00190

收稿日期 2025-04-15 本文编辑 孙敏

引用本文：王娅洁，龙晓宇. 基于多囊卵巢综合征表型分型体系的临床特征总结[J]. 中华生殖与避孕杂志, 2025, 45(10): 1058-1066. DOI: 10.3760/cma.j.cn101441-20250415-00190.

基于多囊卵巢综合征表型分型体系的临床特征总结

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【摘要】 多囊卵巢综合征（polycystic ovary syndrome, PCOS）是育龄期女性常见的内分泌代谢性疾病，其发病机制尚未完全阐明。根据鹿特丹诊断标准，PCOS 可分为 4 种临床表型，4 种表型在腰围、体质量指数（body mass index, BMI）等体格参数、性激素、抗苗勒管激素、代谢性疾病、超声表现和辅助生殖技术结局等方面均呈现显著差异。近年来，随着研究的深入，生物学相关分型、BMI/胰岛素抵抗分型等分型体系的提出，为 PCOS 的临床分型研究提供了新的理论视角。本文系统综述了 PCOS 不同临床表型的特征，以期为 PCOS 的临床诊断、个体化管理和患者健康教育提供理论依据。

【关键词】 多囊卵巢综合征；表型；激素；代谢性疾病；生殖技术，辅助；鹿特丹标准；体格参数

基金项目：2024 年度首都卫生发展科研专项（2024-2-40910）

Clinical characteristics based on the phenotypic classification system of polycystic ovary syndrome

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【Abstract】 Polycystic ovary syndrome (PCOS) is a common endocrine and metabolic disorder among women of reproductive age, and its pathogenesis has not been fully elucidated. According to the Rotterdam diagnostic criteria, PCOS can be classified into four clinical phenotypes, which significantly differ in physical parameters such as waist circumference and body mass index (BMI), as well as in sex hormones, anti-Müllerian hormone levels, metabolic diseases, ultrasound findings, and outcomes of assisted reproductive technology. In recent years, with the deepening of research, new classification systems, such as biology-based phenotyping and BMI/insulin resistance classification, have provided new theoretical perspectives for the clinical classification of PCOS. This article systematically reviews the characteristics of different clinical phenotypes of PCOS,

aiming to provide a theoretical basis for its clinical diagnosis, individualized management, and patient health education.

【Key words】 Polycystic ovary syndrome; Phenotype; Hormones; Metabolic diseases; Reproductive techniques, assisted; Rotterdam criteria; Anthropometric parameters

Fund program: 2024 Capital's Health Development Research Special Project (2024-2-40910)

· 综述 ·

DOI: 10.3760/cmaj.cn101441-20250503-00215

收稿日期 2025-05-03 本文编辑 王李艳

引用本文: 汪荷洁, 李洁, 符雨珂, 等. 卵巢储备功能减退的治疗研究进展[J]. 中华生殖与避孕杂志, 2025, 45(10): 1067-1071. DOI: 10.3760/cmaj.cn101441-20250503-00215.

卵巢储备功能减退的治疗研究进展

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【摘要】 卵巢储备功能减退 (diminished ovarian reserve, DOR) 是导致女性不孕的重要因素之一, 其发病机制复杂, 涉及年龄、遗传、环境、免疫等多重因素。DOR 治疗手段有限, 目前尚无十分有效的治疗方法。近些年再生医学领域的研究, 如间充质干细胞及其衍生物、富血小板血浆、体外激活等技术的兴起, 为重建卵巢功能提供了新希望。本文系统回顾了近五年来 DOR 治疗的研究进展, 涵盖激素治疗、辅助生殖技术、中医治疗、再生医学、营养补充与生活干预及靶向治疗等多个方面, 以期 DOR 的临床管理提供参考。

【关键词】 卵巢储备功能减退; 再生医学; 精准医学

基金项目: 宁波市“科创甬江 2035”关键技术突破计划 (2024Z223); 宁波市临床医学研究中心 (2024L002); 浙江省医药卫生科技计划 (2025KY1413); 浙江省中医药科技计划 (2025ZL526)

Research progress in the treatment of diminished ovarian reserve

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【Abstract】 Diminished ovarian reserve (DOR) is a major cause of female infertility, characterized by a complex and multifactorial etiology involving aging, genetic predisposition, environmental factors, and immune mechanisms. Therapeutic options for DOR remain limited, with no currently established treatments demonstrating consistently robust efficacy. Recent advances in regenerative medicine—including the use of mesenchymal stem cells and their derivatives, platelet-rich plasma and *in vitro* activation—have opened promising new avenues for ovarian function restoration. This review offers a comprehensive summary of research progress in DOR treatment over the past five years, covering hormonal therapies, assisted reproductive technologies, nutritional supplementation and lifestyle modifications, Traditional Chinese Medicine, targeted therapies, and regenerative medicine approaches, with the aim of providing guidance for clinical management of DOR.

【Key words】 Diminished ovarian reserve; Regenerative medicine; Precision medicine

Fund program: Ningbo "Yongjiang S&T 2035" Key Technology Breakthrough Plan (2024Z223); Ningbo Clinical Medical Research Center (2024L002); Zhejiang Medical and Health Science and Technology Program (2025KY1413); Zhejiang Traditional Chinese Medicine Science and Technology Program (2025ZL526)

· 综述 ·

DOI: 10.3760/cma.j.cn101441-20250418-00193

收稿日期 2025-04-18 本文编辑 王李艳

引用本文: 刘亚平, 翟军. 前动力蛋白 2 的生理功能及在生殖系统疾病中的作用[J]. 中华生殖与避孕杂志, 2025, 45(10): 1072-1076. DOI: 10.3760/cma.j.cn101441-20250418-00193.

前动力蛋白 2 的生理功能及在生殖系统疾病中的作用

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【摘要】 前动力蛋白 2 (prokineticin 2, PK2) 是一种含多个半胱氨酸、具有多种生物学功能的分泌蛋白, 参与机体多种生物学过程。PK2 表达及其信号通路异常可导致神经系统、消化系统、免疫系统、生殖系统等全身各系统疾病的发生。本文将重点对 PK2 生理功能及其在生殖系统疾病发生中的作用进行全面综述, 以期为不孕症及妊娠相关疾病的防治提供理论依据。

【关键词】 前动力蛋白 2; 前动力蛋白受体; 生物学作用; 生殖系统疾病

基金项目: 国家自然科学基金 (82071649); 河南省高校重点科研项目 (22A320025)

Physiological functions of prokineticin 2 and its role in reproductive system diseases

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【Abstract】 Prokineticin 2 (PK2) is a secretory protein containing multiple cysteines with various biological functions, participating in numerous physiological processes in the body. Abnormal expression of PK2 and its signaling pathways can lead to diseases in various systems of the body, including the nervous system, digestive system, immune system, reproductive system, and others. This article will focus on a comprehensive review of the physiological functions of PK2 and its role in reproductive system diseases, aiming to provide theoretical support for the prevention and treatment of infertility and pregnancy-related disorders.

【Key words】 Prokineticin 2; Prokineticin receptors; Biological functions; Reproductive system diseases

Fund program: National Natural Science Foundation of China (82071649); Key Scientific Research Projects of Higher Education Institutions in Henan Province (22A320025)

· 综述 ·

DOI: 10.3760/cmaj.cn101441-20250506-00217

收稿日期 2025-05-06 本文编辑 李天琦

引用本文: 宁俊红, 曹海敬, 张婷. 异维 A 酸生殖毒性研究进展与临床管理策略[J]. 中华生殖与避孕杂志, 2025, 45(10): 1077-1080. DOI: 10.3760/cmaj.cn101441-20250506-00217.

异维 A 酸生殖毒性研究进展与临床管理策略

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【摘要】 异维 A 酸是临床治疗重度痤疮的高效常用药物, 但其显著的生殖毒性限制了临床应用。现有文献研究表明, 异维 A 酸通过干扰维甲酸信号通路、诱导氧化应激和细胞凋亡等多通路交叉作用, 对生殖系统产生广泛影响。因此深入解析其生殖毒性机制, 优化临床风险管理策略, 开发更安全的替代药物, 具有重要的临床和现实意义。未来研究可能会聚焦精准医学框架下的机制深化、个体化防控策略及药物创新, 以平衡药物疗效与安全性。本文围绕异维 A 酸对生殖系统的毒性作用, 包括致畸性、对女性和男性生殖功能的影响进行综述, 并深入探讨其分子机制及临床风险管理策略。

【关键词】 异维 A 酸; 生殖毒性; 致畸毒性; 临床管理

Research progress on the reproductive toxicity of isotretinoin and clinical management strategies

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【Abstract】 Isotretinoin is a highly effective and commonly used drug in the clinical treatment of severe acne, but its significant reproductive toxicity limits its clinical application. Current literature studies have shown that isotretinoin exerts widespread effects on the reproductive system through multiple pathways, including interference with the retinoic acid signaling pathway, induction of oxidative stress, and apoptosis. Therefore, in-depth dissection of its reproductive toxicity mechanisms, optimization of clinical risk management strategies, and development of safer alternative drugs are of great clinical and practical significance. Future research may focus on deepening mechanisms under the framework of precision medicine, individualized prevention and control strategies, and drug innovation to balance drug efficacy and safety. This article systematically reviews the toxic effects of isotretinoin on the reproductive system, including teratogenicity, its impact on female and male reproductive function, and explores in depth its molecular mechanisms, and clinical risk management strategies.

【Key words】 Isotretinoin; Reproductive toxicity; Teratogenic toxicity; Clinical management