

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43卷 第7期 2023年7月25日出版



主 管

中国科学技术协会

主 办

中华医学会
上海市生物医药技术研究院
复旦大学附属妇产科医院

编 辑

中华生殖与避孕杂志
编辑委员会
200237,上海市老沪闵路779号
电话:(021)64438169
传真:(021)64438975
Email:rande@sibpt.com
http://zhshzybyzz.yiigle.com

总编辑

乔 杰

编辑部主任

王 健

出 版

《中华医学杂志》社有限责任公司
100710,北京市东四西大街42号
电话(传真):(010)51322059
Email:office@cmaph.org

广告发布登记号

京东市监广登字20200006号

印 刷

上海船舶设备研究所

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,100044)
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.com

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

2023年版权归主办者所有

未经授权,不得转载、摘编本刊
文章,不得使用本刊的版式设计

除非特别声明,本刊刊出的所有
文章不代表中华医学会和本刊
编委会的观点

本刊如有印装质量问题,请向本刊
编辑部调换

目 次

规范与标准

- 卵胞质内单精子注射(ICSI)技术中国专家共识(2023年)659
中国医师协会生殖医学专业委员会

临床研究

- 卵巢低反应人群应用高孕酮状态下促排卵方案中地屈孕酮和醋酸
甲羟孕酮的对比:一项倾向性评分匹配队列研究670
杜明泽 张俊韦 于晓娜 李真 管一春
子宫内膜厚度对IVF-ET助孕患者早期自然流产结局的影响
及阈值效应分析676
程田田 范晶晶 原芳 赵华 于岚 张翠莲 何巧花
拮抗剂方案卵巢高反应人群GnRH-a单药或联合低剂量
hCG扳机全胚冻融临床结局分析683
涂彬彬 潘宁宁 陈立雪 黄锦 李敏 杨蕊 刘平 李蓉 乔杰
多囊卵巢综合征患者氧化应激水平对卵子
和胚胎质量的影响690
张琳 张岭 吴丽梅 徐维海 金珍 金帆
无创产前检测在慎用人群胎儿染色体非整倍体中的
效能分析697
李娜 琚端 王秀艳 翟春雅 龙英霞 马艳红 王秋霞 张颖
袁碧波 李晓洲

实验研究

- X射线辐射远端效应诱发小鼠卵巢储备功能下降的
实验研究703
周莹 郭妍妍 李岩 叶舒婷 张步美 黎小佩 王建梅 杜湧瑞

临床报道

- 孕前扩展性携带者筛查在中国汉族育龄人群中的
应用价值713
谭丽 赵培娟 齐超凡 程兰兰 禹果 赵冬梅 宋玉霞 项云改
梁雪琪 彭默然
孕酮对入孕晚期DSCs体外增殖及TNF- α 、IL-6基因表达
水平的影响718
逯非凡 李媛 顾仲毅 李励 杨倩倩 徐畅 邓轶方 管睿
男性染色体平衡易位携带者染色体断裂点与生精缺陷的
关系初步探讨723
张剑 陈小露 王文博 陈佳燕 葛运生

现场调查

中国不孕症患者治疗动因及阻因的调查研究729
 李嘉 程章 Randy Polyanna Po 郑祖庚 Marie Markert 杨蕊
接受IVF-ET治疗的夫妇中男性挫败感现状及其影响因素分析735
 李超凤 陈丹 孔祥麟 唐诗 伍雅琴 范璞璞

综 述

子宫内膜异位症患者孕激素抵抗的研究进展740
 官华成 徐洁颖 徐步芳
经阴道超声引导下取卵术患者镇痛方式的研究进展745
 王丽 文宏贵 谭长秀 杨娜 兰灵 罗红
巨噬细胞在多囊卵巢综合征中的研究进展752
 赫少菁 李赛姣
逆转录转座子LINE-1介导配子和胚胎发育异常的研究进展757
 平昀鹭 赵小莹 冯晓玲
卵母细胞体外成熟技术发展现状及应用进展763
 胡静怡 杨琰 姚桂东

《中华生殖与避孕杂志》稿约 封二
本期责任编辑 乔杰 本期责任编辑 王李艳 本期责任排版 牟丽红

CHINESE JOURNAL OF REPRODUCTION AND CONTRACEPTION

(Original title: *Reproduction and Contraception*)

Monthly

Established in December 1980

Volume 43, Number 7

July 25, 2023



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

Editing

Editorial Board of Chinese Journal of Reproduction and Contraception
779 Laohumin Road, Shanghai 200237, China
Tel: 0086-21-64438169
Fax: 0086-21-64438975
Email: rande@sibpt.com
http://zhshzybyzz.yiigle.com

Editor-in-Chief

Qiao Jie

Managing Director

Wang Jian

Publishing

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

Printing

Shanghai Marine Equipment Research Institute

Overseas Distributor

China International Book
Trading Corporation
P.O. Box 399, Beijing 100044, 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
Email: rande@sibpt.com

CSSN

ISSN 2096-2916
CN 10-1441/R

Copyright © 2023 by the all sponsors

No content published by the journals of Chinese Medical Association may be reproduced or abridged without authorization. Please do not use or copy the layout and design of the journals without permission.

All articles published represent the opinions of the authors, and do not reflect the official policy of the Chinese Medical Association or the Editorial Board, unless this is clearly specified.

CONTENTS IN BRIEF

Standards and Specifications

- Chinese expert consensus on intracytoplasmic sperm injection (2023)659
Chinese Association of Reproductive Medicine

Clinical Studies

- Comparison of dydrogesterone and medroxyprogesterone acetate in progestin-primed ovarian stimulation protocol for patients with poor ovarian response: a propensity score matching cohort study670
Du Mingze, Zhang Junwei, Yu Xiaona, Li Zhen, Guan Yichun

- Influence of endometrial thickness on the outcome of spontaneous abortion in IVF-ET cycle and threshold effect analysis676
Cheng Tiantian, Fan Jingjing, Yuan Fang, Zhao Hua, Yu Lan, Zhang Cuilian, He Qiaohua

- Analysis of clinical outcome of whole frozen-thawed embryo transfer in patients with high ovarian response using GnRH-agonist trigger or combined with low-dose hCG trigger in GnRH-antagonist protocol683
Tu Binbin, Pan Ningning, Chen Lixue, Huang Jin, Li Min, Yang Rui, Liu Ping, Li Rong, Qiao Jie

- Effect of oxidative stress on the quality of oocytes and embryos in patients with polycystic ovary syndrome690
Zhang Lin, Zhang Ling, Wu Limei, Xu Weihai, Jin Zhen, Jin Fan

- Efficacy of noninvasive prenatal testing in fetal chromosome aneuploidy in cautious population697
Li Na, Ju Duan, Wang Xiuyan, Zhai Chunya, Long Yingxia, Ma Yanhong, Wang Qiuxia, Zhang Ying, Yuan Bibo, Li Xiaozhou

Laboratory Studies

- Diminished ovarian reserve induced by X-ray radiation-induced abscopal effects in mice: an experimental study703
Zhou Ying, Guo Yanyan, Li Yan, Ye Shuting, Zhang Bumei, Li Xiaopei, Wang Jianmei, Du Yongrui

Clinical Reports

- Application value of preconception expanded carrier screening in Chinese Han population of childbearing age713
Tan Li, Zhao Peijuan, Qi Yuefan, Cheng Lanlan, Yu Guo, Zhao Dongmei, Song Yuxia, Xiang Yungai, Liang Xueqi, Peng Moran

- Effects of progesterone on the proliferation and expressions of *TNF-α* and *IL-6* genes of human decidual stromal cells in late pregnancy *in vitro*718
Lu Feifan, Li Yuan, Gu Zhongyi, Li Li, Yang Qianqian, Xu Chang, Deng Yifang, Guan Rui

- A preliminary study on the relationship between chromosome breakpoint and spermatogenesis dysfunction in the male carriers of chromosomal balanced translocation723
Zhang Jian, Chen Xiaolu, Wang Wenbo, Chen Jiayan, Ge Yunsheng

Field Investigations

- Investigation on the treatment motivations and barriers of infertility patients in China**729
Li Jia, Cheng Zhang, Po Randy Polyanna, Zheng Zugeng, Markert Marie, Yang Rui
- Analysis of the current situation of defeat in men undergoing IVF-ET therapy and its influencing factors**735
Li Chaofeng, Chen Dan, Kong Xianglin, Tang Shi, Wu Yaqin, Fan Yingying

Reviews

- Research progress of progesterone resistance in patients with endometriosis**740
Guan Huacheng, Xu Jieying, Xu Bufang
- Research progress in analgesic methods of patients undergoing transvaginal ultrasound guided oocyte retrieval**745
Wang Li, Wen Honggui, Tan Changxiu, Yang Na, Lan Ling, Luo Hong
- Research progress of macrophages in polycystic ovary syndrome**752
He Shaojing, Li Saijiao
- Research progress of retrotransposon LINE-1 mediating abnormal gamete and embryo development**757
Ping Yunlu, Zhao Xiaoxuan, Feng Xiaoling
- Development status and application progress of oocyte *in vitro* maturation technology**763
Hu Jingyi, Yang Guang, Yao Guidong

DOI: 10.3760/cmaj.cn101441-20230228-00076

收稿日期 2023-03-01 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. 卵胞质内单精子注射 (ICSI) 技术中国专家共识(2023 年)[J].

中华生殖与避孕杂志, 2023, 43(7): 659-669. DOI: 10.3760/cmaj.cn101441-20230228-00076.

卵胞质内单精子注射 (ICSI) 技术 中国专家共识 (2023 年)

中国医师协会生殖医学专业委员会

通信作者: 李蓉, 北京大学第三医院妇产科生殖医学中心, 北京 100191,

Email: roseli001@sina.com; 李达, 中国医科大学附属盛京医院生殖医

学中心, 沈阳 110022, Email: leeda@sina.cn; 章志国, 安徽医科大学

第一附属医院妇产科生殖中心, 合肥 230022, Email:

zhangzhiguo@ahmu.edu.cn

【摘要】 人类卵胞质内单精子注射 (intracytoplasmic sperm injection, ICSI) 技术开展至今已有 30 余年。其最初主要应用于针对严重少、弱、畸形精子症导致的男性不育患者的治疗, 但随着未成熟卵体外培养、卵子冷冻、胚胎植入前遗传学检测等辅助生殖技术的开展, ICSI 使用比例已大幅提升。虽然目前 ICSI 技术相对成熟, 但仍有很多细节值得关注和完善。为规范与优化人类辅助生殖技术从业者的 ICSI 操作, 由中国医师协会生殖医学专业委员会发起, 并联合全国多家生殖医学中心共同编撰了本共识。

【关键词】 生殖技术, 辅助; 精子注射, 细胞质内; 共识

Chinese expert consensus on intracytoplasmic sperm injection (2023)

Chinese Association of Reproductive Medicine

Corresponding authors: Li Rong, Center for Reproductive Medicine, Department of Obstetrics and Gynecology, Peking University Third Hospital, Beijing 100191, China, Email: roseli001@sina.com; Li Da, Center for Reproductive Medicine, Shengjing Hospital of China Medical University, Shenyang 110022, China, Email: leeda@sina.cn; Zhang Zhiguo, Reproductive Medicine Center, Department of Obstetrics and

Gynecology, the First Affiliated Hospital of Anhui Medical University, Hefei 230022, China, Email: zhangzhiguo@ahmu.edu.cn

【Abstract】 Intracytoplasmic sperm injection (ICSI) has been developed for over 30 years. Initially, it was mainly used in the treatment of male infertility caused by severe oligozoospermia, asthenozoospermia and teratozoospermia. However, the use of ICSI has substantially increased due to the extensive development of assisted reproductive technology such as *in vitro* maturation of immature oocytes, oocyte cryopreservation and preimplantation genetic testing. Although ICSI technology is relatively mature, there are still many details that need to be improved. In order to standardize and optimize the technology of ICSI, this consensus is initiated by the Chinese Association of Reproductive Medicine, and coedited with other reproductive medicine centers.

【Key words】 Reproductive techniques, assisted; Sperm injection, intracytoplasmic; Consensus

DOI: 10.3760/cmaj.cn101441-20220304-00096

收稿日期 2022-03-07 本文编辑 王李艳

引用本文: 杜明泽, 张俊韦, 于晓娜, 等. 卵巢低反应人群应用高孕酮状态下促排卵方案中地屈孕酮和醋酸甲羟孕酮的对比: 一项倾向性评分匹配队列研究[J]. 中华生殖与避孕杂志, 2023, 43(7): 670-675. DOI: 10.3760/cmaj.cn101441-20220304-00096.

• 临床研究 •

卵巢低反应人群应用高孕酮状态下促排卵方案中地屈孕酮和醋酸甲羟孕酮的对比: 一项倾向性评分匹配队列研究

杜明泽 张俊韦 于晓娜 李真 管一春

郑州大学第三附属医院生殖医学科, 郑州 450052

通信作者: 管一春, Email: lisamayguan@163.com, 电话: +86-371-

66903315

【摘要】 目的 比较高孕酮状态下促排卵 (progestin-primed ovarian stimulation, PPOS) 方案中地屈孕酮和醋酸甲羟孕酮 (medroxyprogesterone acetate, MPA) 在卵巢低反应 (poor ovarian response, POR) 人群中的临床应用结局。方法 本研究属于单中心回顾性队列研究。纳入 2019 年 1 月至 2021 年 9 月

期间在郑州大学第三附属医院生殖医学科行 PPOS 方案助孕的 POR 患者。根据使用的孕激素药物不同,分为地屈孕酮组和 MPA 组。以 1:3 进行倾向性评分匹配(propensity score matching, PSM)校正混杂因素。观察指标为可利用胚胎数、获卵数、双原核(two pronuclei, 2PN)数、优质胚胎数、全胚冷冻第一周期移植临床妊娠率和持续妊娠率。结果 共纳入 1962 个周期,其中地屈孕酮组共 494 个周期,MPA 组共 1468 个周期。两组间不孕因素差异有统计学意义($P=0.045$),余基础资料差异均无统计学意义(均 $P>0.05$)。地屈孕酮组的促性腺激素(gonadotropin, Gn)启动量[300 (225, 300) U]低于 MPA 组[300 (300, 300) U, $P<0.001$]。Gn 使用时间、Gn 使用总量、早发黄体生成素峰、获卵数、2PN 数、可利用胚胎数和优质胚胎数在组间差异均无统计学意义(均 $P>0.05$)。共有 1331 个周期进行了第 1 次冻融胚胎移植,其中地屈孕酮组 268 个周期,MPA 组 1063 个周期。移植日子宫内膜厚度、移植胚胎数、移植胚胎阶段、子宫内膜准备方案组间差异均无统计学意义(均 $P>0.05$)。两组间的临床妊娠率和持续妊娠率差异均无统计学意义(均 $P>0.05$)。结论 对于 POR 患者,PPOS 方案中地屈孕酮和 MPA 可获得相似的临床结局,表明地屈孕酮可作为 PPOS 方案有效的选择之一。

【关键词】 地屈孕酮; 醋酸甲羟孕酮; 高孕酮状态下促排卵; 临床妊娠率

基金项目: 2021 年度河南省医学科技攻关联合共建项目(LHGJ20210451)

Comparison of dydrogesterone and medroxyprogesterone acetate in progestin-primed ovarian stimulation protocol for patients with poor ovarian response: a propensity score matching cohort study

Du Mingze, Zhang Junwei, Yu Xiaona, Li Zhen, Guan Yichun

Reproductive Center of the Third Affiliated Hospital of Zhengzhou University, Zhengzhou 450052, China

Corresponding author: Guan Yichun, Email: lisamayguan@163.com, Tel: +86-371-66903315

【Abstract】 **Objective** To compare the clinical outcomes of dydrogesterone and medroxyprogesterone acetate (MPA) in the progestin-primed ovarian stimulation (PPOS) protocol for patients with poor ovarian response (POR). **Methods** This study was a single-center retrospective cohort study. POR patients who underwent PPOS protocol in Reproductive Center of the Third Affiliated Hospital of Zhengzhou University from January 2019 to September 2021 were included for analysis. According to different progestin drugs used, they were divided into dydrogesterone group and MPA group. Propensity score matching (PSM) was performed 1:3 to correct for confounding factors. Outcome measures were the number of available embryos, oocytes retrieved, two pronuclei (2PN) and high-quality embryos, the clinical pregnancy rate and the continuing pregnancy rate in the first frozen embryo transfer cycle. **Results** A total of 1962 cycles were included, including 494 cycles in the dydrogesterone group and 1468 cycles in the MPA group. There was a statistically significant difference in infertility factors between the two groups ($P=0.045$). The other baseline characteristics were not significantly different (all $P>0.05$). The initiating dosage of gonadotropin (Gn) in the dydrogesterone group

[300 (225, 300) U] was lower than that in the MPA group [300 (300, 300) U, $P < 0.001$]. There were no significant differences in the duration and total dosage of Gn used, premature luteinizing hormone surge rate, the number of oocytes retrieved, the number of 2PN, the number of available embryos and the number of good-quality embryos between the two groups (all $P > 0.05$). A total of 1 331 cycles underwent the first frozen-thawed embryo transfer, including 268 cycles in the dydrogesterone group and 1 063 cycles in the MPA group. There were no significant differences in endometrial thickness on the day of embryo transfer, the number of transferred embryos, the stage of transferred embryos, and the endometrial preparation protocols between the two groups (all $P > 0.05$). There were no significant differences in the clinical pregnancy rate and the ongoing pregnancy rate between the two groups ($P = 0.832$, $P = 0.798$). **Conclusion** For POR patients, similar clinical outcomes were obtained with dydrogesterone and MPA in the PPOS protocol, suggesting that dydrogesterone can be an effective alternative to the PPOS protocol.

【Key words】 Dydrogesterone; Medroxyprogesterone acetate; Progestin-primed ovarian stimulation; Clinical pregnancy rate

Fund program: 2021 Henan Province Medical Science and Technology Research and Joint Construction Project (LHGJ20210451)

DOI: 10.3760/cma.j.cn101441-20220322-00126

收稿日期 2022-03-24 本文编辑 王李艳

引用本文: 程田田, 范晶晶, 原芳, 等. 子宫内膜厚度对 IVF-ET 助孕患者早期自然流产结局的影响及阈值效应分析[J]. 中华生殖与避孕杂志, 2023, 43(7): 676-682. DOI: 10.3760/cma.j.cn101441-20220322-00126.

• 临床研究 •

子宫内膜厚度对 IVF-ET 助孕患者 早期自然流产结局的影响及阈值效 应分析

程田田 范晶晶 原芳 赵华 于岚 张翠莲 何巧花
河南大学人民医院 河南省人民医院 郑州大学人民医院生殖中心, 郑
州 450003

通信作者: 何巧花, Email: hqhuaaaa@126.com, 电话: +86-371-
65580857

【摘要】 目的 探讨体外受精 (*in vitro* fertilization, IVF) 助孕周期中人绒毛膜促性腺激素 (human chorionic gonadotropin, hCG) 扳机日或子宫内膜转化日子宫内膜厚度 (endometrial thickness, EMT) 与助孕后早期自然流产发生的关系并进行阈值效应分析。方法 回顾性队列研究分析 2010 年 1 月至 2018 年 12 月期间在河南省人民医院生殖中心首次行 IVF 助孕的不孕症患者的临床资料, 根据 hCG 扳机日或子宫内膜转化日 EMT 分为 A 组 (EMT<8 mm)、B 组 (8 mm≤EMT<10 mm)、C 组 (10 mm≤EMT<12 mm) 和 D 组 (EMT≥12 mm)。通过单因素分析、多因素 logistic 回归分析、平滑曲线拟合及阈值效应分析探讨 EMT 对 IVF 助孕周期自然流产率的影响。结果 在 IVF 助孕的 12 912 个周期中, 8 674 个周期临床妊娠, 1 102 个周期发生早期自然流产, 自然流产率为 12.70%。单因素回归分析显示, 年龄、体质指数、不孕年限、不孕类型、不孕因素中的男性因素、自然流产次数、EMT、移植胚胎数构成比是早期自然流产率的影响因素 (均 $P<0.05$)。多因素 logistic 回归分析中调整混杂因素, 以 A 组作为对照组, 结果显示, 卵裂期胚胎移植时 B、C 和 D 组早期自然流产率均显著低于 A 组 ($P=0.008$, $P<0.001$, $P<0.001$); 囊胚移植时随 EMT 增加早期自然流产率差异无统计学意义 ($P>0.05$)。阈值效应分析结果显示, 卵裂期胚胎移植时当 EMT<10.3 mm 时, 早期自然流产率随 EMT 的增加而显著下降, EMT 每增加 1 mm 自然流产率降低 14.70% ($OR=0.853$, 95% CI : 0.792~0.918, $P<0.001$); 当 EMT≥10.3 mm 时, 自然流产率差异无统计学意义 ($OR=1.006$, 95% CI : 0.959~1.056, $P=0.798$); 囊胚移植周期早期自然流产率随 EMT 增加变化平稳, 差异无统计学意义 ($P>0.05$)。结论 在 IVF 助孕周期中, 卵裂期胚胎移植 EMT 与自然流产呈曲线关系, EMT 达到阈值 10.3 mm 之前, 自然流产率随 EMT 增加而显著下降。

【关键词】 流产, 自然; 受精, 体外; 囊胚; 子宫内膜厚度; 胚胎
基金项目: 河南省科技攻关项目 (182102310134)

Influence of endometrial thickness on the outcome of spontaneous abortion in IVF-ET cycle and threshold effect analysis

Cheng Tiantian, Fan Jingjing, Yuan Fang, Zhao Hua, Yu Lan, Zhang Cuilian, He Qiaohua
Reproductive Center of People's Hospital of Henan University, Henan Provincial People's Hospital, People's Hospital of Zhengzhou University, Zhengzhou 450003, China
Corresponding author: He Qiaohua, Email: hqhuaaaa@126.com, Tel: +86-371-65580857

【Abstract】 Objective To study the relationship between endometrial thickness (EMT) at the time of human chorionic gonadotropin (hCG) trigger day or endometrial transformation day and spontaneous abortion in *in vitro* fertilization (IVF) cycle and analyze the threshold effect. **Methods** A retrospective cohort study was performed to analyze the clinical data of infertile patients who underwent the first IVF cycle in the Reproductive Center of Henan Provincial People's Hospital from January 2010 to December 2018. The patients were divided into four groups according to EMT, group A: EMT<8 mm, group B: 8 mm≤EMT<10 mm, group C: 10 mm≤EMT<12 mm, and group D: EMT≥12 mm. The effect of EMT on spontaneous abortion rate during IVF cycle was investigated by univariate analysis, multivariate logistic regression analysis, smooth curve fitting and the threshold effect analysis. **Results** In all 12 912 IVF cycles, 8 674 cycles got clinical pregnancy, 1 102 cycles

resulted in early spontaneous miscarriage and the spontaneous abortion rate was 12.70%. Univariate regression analysis showed that age, body mass index, duration of infertility, type of infertility, male factors in infertility factors, No. of spontaneous abortions, EMT and No. of embryos transferred had influences on the spontaneous abortion rate (all $P<0.05$). Multivariate logistic regression analysis adjusted for confounding factors and group A was used as control group. The results showed that the spontaneous abortion rate of groups B, C and D was significantly lower than that of group A during embryo transfer at cleavage stage ($P=0.008$, $P<0.001$, $P<0.001$); there was no significant difference in spontaneous abortion rate with the increase of EMT during blastocyst stage ($P>0.05$). The threshold effect analysis showed that when the EMT was <10.3 mm, the spontaneous abortion rate decreased significantly with the increasing of EMT for cleavage embryo, and the spontaneous abortion rate decreased 14.7% with each 1 mm increment in EMT ($OR=0.853$, 95% CI : 0.792–0.918, $P<0.001$); there was no significant difference in spontaneous abortion rate when EMT was ≥ 10.3 mm ($OR=1.006$, 95% CI : 0.959–1.056, $P=0.798$). The spontaneous abortion rate changed steadily with the increase of EMT, and the difference was not statistically significant for blastocyst embryo ($P>0.05$).

Conclusion In IVF cycle, the relationship between EMT and spontaneous abortion was curvilinear for cleavage embryo. Before the EMT reached the threshold of 10.3 mm, the spontaneous abortion rate decreased significantly with the increase of EMT.

【Key words】 Abortions, spontaneous; Fertilization *in vitro*; Blastocyst; Endometrium; Embryo

Fund program: Key Science and Technology Project of Henan Province (182102310134)

DOI: 10.3760/cmaj.cn101441-20220406-00145

收稿日期 2022-04-24 本文编辑 王李艳

引用本文: 涂彬彬, 潘宁宁, 陈立雪, 等. 拮抗剂方案卵巢高反应人群 GnRH-a 单药或联合低剂量 hCG 扳机全胚冻融临床结局分析[J]. 中华生殖与避孕杂志, 2023, 43(7): 683-689. DOI: 10.3760/cmaj.cn101441-20220406-00145.

• 临床研究 •

拮抗剂方案卵巢高反应人群 GnRH-a 单药或联合低剂量 hCG 扳机全胚冻 融临床结局分析

涂彬彬 潘宁宁 陈立雪 黄锦 李敏 杨蕊 刘平 李蓉 乔杰

北京大学第三医院妇产科生殖医学中心, 北京 100191

通信作者: 杨蕊, Email: yrjeff@126.com, 电话: +86-10-82266625

【摘要】 目的 比较拮抗剂方案中卵巢高反应人群使用促性腺激素释放激素激动剂 (gonadotropin-releasing hormone agonist, GnRH-a) 单药扳机或联合低剂量人绒毛膜促性腺激素 (human chorionic gonadotropin, hCG) 双扳机全胚胎冻融移植的临床结局。方法 回顾性队列研究分析 2018 年 1 月至 2020 年 12 月期间在北京大学第三医院妇产科生殖医学中心行拮抗剂方案体外受精/卵胞质内单精子注射 (*in vitro* fertilization/intracytoplasmic sperm injection, IVF/ICSI) 助孕的卵巢高反应人群的临床资料, 根据扳机方案分为 GnRH-a 单药扳机组 (A 组, $n=251$) 和 GnRH-a 联合低剂量 hCG (2000 U) 双扳机组 (B 组, $n=741$)。对两组患者的周期结局、妊娠结局及早发型重度卵巢过度刺激综合征 (ovarian hyperstimulation syndrome, OHSS) 发生率进行比较。结果 两组患者的基本特征差异均无统计学意义 (均 $P>0.05$)。A 组扳机日的雌二醇水平 [$(22\,905.84\pm9\,513.28)$ pmol/L]、胚胎数 [(18.84 ± 9.50) 枚]、双原核 (two pronuclei, 2PN) 数 [(16.06 ± 8.24) 枚]、优质胚胎数 [(11.25 ± 6.92) 枚] 及胚胎形成率 [68.6% ($4\,730/6\,899$)] 显著高于 B 组 [$(17\,200.82\pm6\,811.64)$ pmol/L, $P<0.001$; (17.34 ± 8.04) 枚, $P=0.025$; (14.87 ± 7.07) 枚, $P=0.042$; (10.25 ± 5.97) 枚, $P=0.027$; 66.5% ($12\,852/19\,326$), $P=0.002$] , 但两组患者的获卵数、成熟卵率和优质胚胎率差异均没有统计学意义 (均 $P>0.05$)。两组患者的每解冻移植周期 hCG 阳性率、临床妊娠率、流产率、异位妊娠率、持续妊娠率、活产率 [包括所有移植周期、第 3 天 (day 3, D3) 胚胎移植周期、囊胚移植周期] 差异均没有统计学意义 (均 $P>0.05$)。两组患者的每促排卵周期累积持续妊娠率、累积活产率、低出生体质量儿比例和出生缺陷儿比例差异亦没有统计学意义 (均 $P>0.05$)。A 组早发型重度 OHSS 发生率 (0%) 小于 B 组 [1.5% ($11/741$)] , 但差异没有统计学意义 ($P>0.05$)。结论 拮抗剂方案中使用 GnRH-a 单药扳机后全胚胎冻融移植的妊娠结局与联合低剂量 hCG 双扳机相似, 且 GnRH-a 单药扳机的早发型重度 OHSS 发生风险低。因此, 对于卵巢高反应人群, IVF/ICSI 周期拮抗剂方案中采用 GnRH-a 单药扳机后全胚冷冻再进行解冻周期移植不失为一个既不损失妊娠结局又能将早发型重度 OHSS 风险降到最低的选择。

【关键词】 拮抗剂方案; 促性腺激素释放激素激动剂扳机; 双扳机; 冻融胚胎移植

基金项目: 北京市科技计划 (Z191100006619085); 国家自然科学基金 (82001510、82171632); 国家重点研发计划 (2021YFC2700605)

Analysis of clinical outcome of whole frozen-thawed embryo transfer in patients with high ovarian response using GnRH-agonist trigger or combined with low-dose hCG trigger in GnRH-antagonist protocol

Tu Binbin, Pan Ningning, Chen Lixue, Huang Jin, Li Min, Yang Rui, Liu Ping, Li Rong, Qiao Jie

Center for Reproductive Medicine, Department of Obstetrics and Gynecology, Peking University Third Hospital, Beijing 100191, China

Corresponding author: Yang Rui, Email: yrjeff@126.com, Tel: +86-10-82266625

【Abstract】 Objective To compare the clinical outcome of whole frozen-thawed embryo transfer in patients with high ovarian response using gonadotropin-releasing hormone agonist (GnRH-a) single trigger or combined with low-dose human chorionic gonadotropin (hCG) dual trigger in the gonadotropin-releasing hormone antagonist (GnRH-A) protocol. **Methods** Retrospective cohort study was conducted in Center for Reproductive Medicine, Department of Obstetrics and Gynecology of Peking University Third Hospital between January 2018 to December 2020, and the patients with high ovarian response undergoing *in vitro* fertilization/intracytoplasmic sperm injection (IVF/ICSI) were divided into GnRH-a single trigger group (group A, $n=251$) and GnRH-a combined with low-dose hCG dual trigger group (group B, $n=741$) according to the trigger protocol. The clinical outcome was compared between the two groups. **Results** There were no significant differences in clinical characteristics between group A and group B. Estrogen level on the day of trigger, number of embryos formed, number of two pronuclei (2PN) embryos formed, number of high-quality embryos formed and rate of embryo formation in group A were significantly higher than those in group B [(22 905.84±9 513.28) pmol/L vs. (17 200.82±6 811.64) pmol/L, $P<0.001$; 18.84±9.50 vs. 17.34±8.04, $P=0.025$; 16.06±8.24 vs. 14.87±7.07, $P=0.042$; 11.25±6.92 vs. 10.25±5.97, $P=0.027$; 68.6% (4 730/6 899) vs. 66.5% (12 852/19 326), $P=0.002$]. However, there were no significant differences in number of oocytes retrieved, mature oocyte rate and high-quality embryo rate between group A and group B (all $P>0.05$). There were also no significant differences in hCG positive rate, clinical pregnancy rate, abortion rate, ectopic pregnancy rate, persistent pregnancy rate and live birth rate per frozen-thawed embryo transfer between the two groups (all $P>0.05$). There were no significant differences in cumulative persistent pregnancy rate, cumulative live birth rate, proportion of low birth weight infants and birth defects per ovarian stimulation cycle between the two groups (all $P>0.05$). The incidence of early-onset severe ovarian hyperstimulation syndrome (OHSS) in group A was lower than that in group B, but there was no significant difference [0% vs. 1.5% (11/741), $P=0.075$]. **Conclusion** The pregnancy outcome of whole frozen-thawed embryo transfer in patients with high ovarian response using GnRH-a single trigger was comparable to dual trigger combined with low-dose hCG in the GnRH-A protocol, and the risk of early onset severe OHSS was low. Therefore, in patients with high ovarian response in IVF/ICSI cycle using GnRH-A protocol, the use of GnRH-a single trigger followed by whole frozen-thawed embryo transfer could be considered as an optimal choice to minimize the risk of early onset OHSS without loss of pregnancy outcome.

【 Key words 】 Gonadotropin-releasing hormone antagonist protocol; Gonadotropin-releasing hormone agonist trigger; Dual trigger; Frozen-thawed embryo transfer

Fund program: Beijing Science and Technology Planning Project (Z191100006619085); National Natural Science Foundation of China (82001510, 8217163); National Key Research and Development Program (2021YFC2700605)

DOI: 10.3760/cma.j.cn101441-20220331-00137

收稿日期 2022-04-13 本文编辑 李天琦

引用本文: 张琳, 张岭, 吴丽梅, 等. 多囊卵巢综合征患者氧化应激水平对卵子和胚胎质量的影响[J]. 中华生殖与避孕杂志, 2023, 43(7): 690-696. DOI: 10.3760/cma.j.cn101441-20220331-00137.

· 临床研究 ·

多囊卵巢综合征患者氧化应激水平对卵子和胚胎质量的影响

张琳^{1,2} 张岭² 吴丽梅² 徐维海² 金珍² 金帆¹

¹浙江大学医学院附属妇产科医院生殖内分泌科, 杭州 310005; ²浙江省人民医院(杭州医学院附属人民医院)生殖医学中心生殖内分泌科, 杭州 310014

通信作者: 金帆, Email: jinfan@zju.edu.cn, 电话: +86-571-87013871

【摘要】 目的 探讨多囊卵巢综合征(polycystic ovary syndrome, PCOS)患者血清及卵泡液氧化应激水平与卵子及胚胎质量的关系。方法 采用前瞻性随访研究分析 2019 年 1 月至 2020 年 10 月期间在浙江省人民医院生殖医学中心行体外受精治疗的 67 例 PCOS 患者(PCOS 组)和 66 例单纯输卵管因素行体外受精的患者(对照组)的临床资料。采集患者取卵日血清及直径大于 18 mm 卵泡的卵泡液。比色法检测总抗氧化能力(total antioxidant capacity, TAC)、超氧化物歧化酶(superoxide dismutase, SOD)和丙二醛(malondialdehyde, MDA)水平, 分析氧化应激指标与卵子质量、胚胎培养结局和移植后临床结局的相关性。结果 PCOS 组血清 SOD 水平 $[(22.11 \pm 3.70) \text{ U/mL}]$ 显著低于对照组 $[(25.70 \pm 3.32) \text{ U/mL}]$, $P < 0.001$; PCOS 组的卵泡液 TAC 水平 $[(0.62 \pm 0.05) \text{ mmol/L}]$ 、MDA 水平 $[(16.64 \pm 3.85) \text{ nmol/mL}]$ 和血清 MDA 水平 $[(18.20 \pm 4.68) \text{ nmol/mL}]$ 显著高于对照组 $[(0.53 \pm 0.04) \text{ mmol/L}]$, $P < 0.001$; $[(13.74 \pm 2.28) \text{ nmol/mL}]$, $P < 0.001$; $[(15.37 \pm 5.34) \text{ nmol/mL}]$, $P = 0.008$; PCOS 组优质胚胎率 $[34.1\% (34/100)]$ 、着床率 $[49.5\% (54/109)]$ 、临床妊娠率 $[60.9\% (39/64)]$ 和活产率 $[50.0\% (32/64)]$ 均低于对照组 $[41.7\% (306/733)]$, $P = 0.013$; $58.7\% (54/92)$, $P = 0.023$; $70.3\% (45/64)$, $P = 0.006$; $59.4\% (38/64)$, $P = 0.007$, 差异均有统计学意义; 卵泡液 TAC 水平与优质胚胎率呈显著负相关($\beta = -1.83$, $P = 0.012$); 各氧化应激指标与临床结局无显著相关性。结论 PCOS 患者卵泡液 TAC 水平升高, 过高的卵泡液 TAC 水平可能是胚胎质量低下的危险因素之一。

【关键词】 受精, 体外; 氧化应激; 多囊卵巢综合征; 胚胎发育

基金项目: 浙江省医药卫生科技计划项目(2019RC116); 浙江省 151 人才项目

Effect of oxidative stress on the quality of oocytes and embryos in patients with polycystic ovary syndrome

Zhang Lin^{1,2}, Zhang Ling², Wu Limei², Xu Weihai², Jin Zhen², Jin Fan¹

¹ Department of Reproductive Endocrinology, Women's Hospital School of Medicine Zhejiang University, Hangzhou 310005, China; ² Department of Reproductive Endocrinology, Center for Reproductive Medicine, Zhejiang Provincial People's Hospital (People's Hospital Affiliated Hangzhou Medical College), Hangzhou 310014, China

Corresponding author: Jin Fan, Email: jinfan@zju.edu.cn, Tel: +86-571-87013871

【Abstract】 Objective To investigate the relationship of oxidative stress levels in serum and follicular fluid of polycystic ovary syndrome (PCOS) patients with the quality of oocytes and embryos. **Methods** A prospective follow-up study was conducted to analyze 67 patients with PCOS (PCOS group) and 66 infertility patients with simple fallopian tube factors (control group) who underwent *in vitro* fertilization in Center for Reproductive Medicine, Zhejiang Provincial People's Hospital from January 2019 to October 2020. Serum and follicular fluid from the follicles with a diameter of more than 18 mm were collected on the oocyte retrieval day. Colorimetric method was used to detect the levels of total antioxidant activity (TAC), superoxide dismutase (SOD), and malondialdehyde (MDA), and the differences of those oxidative stress indicators between the two groups were compared and the correlation of those parameters with oocyte quality, embryo development and clinical outcomes were analyzed. **Results** The serum SOD level of the PCOS group [(22.11±3.70) U/mL] was significantly lower than that of control group [(25.70±3.32) U/mL, $P<0.001$]. The follicular fluid TAC level [(0.62±0.05) mmol/L], MDA level [(16.64±3.85) nmol/mL] and serum MDA level [(18.20±4.68) nmol/mL] of the PCOS group were significantly higher than those of control group [(0.53±0.04) mmol/L, $P<0.001$; (13.74±2.28) nmol/mL, $P<0.001$; (15.37±5.34) nmol/mL, $P=0.008$]. The good-quality embryo rate [34.1% (341/1 000)], the implantation rate [49.5% (54/109)], the clinical pregnancy rate [60.9% (39/64)] and the live birth rate [50.0% (32/64)] in the PCOS group were statistically different from those in control group [41.7% (306/733), $P=0.013$; 58.7% (54/92), $P=0.023$; 70.3% (45/64), $P=0.006$; 59.4% (38/64), $P=0.007$]. There was a negative correlation between the TAC level in follicular fluid and the rate of good-quality embryo ($\beta=-1.83$, $P=0.012$). There was no significant correlation between oxidative stress indicators and clinical outcomes. **Conclusion** The TAC level of follicular fluid in PCOS patients is elevated, and increased TAC level in follicular fluid may be one of the risk factors for poor embryo quality.

【Key words】 Fertilization *in vitro*; Oxidative stress; Polycystic ovary syndrome; Embryonic development

Fund program: Zhejiang Province Medicine and Health Science and Technology Program (2019RC116); Zhejiang Province 151 Talent Project

DOI: 10.3760/cma.j.cn101441-20220218-00070

收稿日期 2022-02-19 本文编辑 孙敏

引用本文：李娜, 琚端, 王秀艳, 等. 无创产前检测在慎用人群胎儿染色体非整倍体中的效能分析[J]. 中华生殖与避孕杂志, 2023, 43(7): 697-702. DOI: 10.3760/cmaj.cn101441-20220218-00070.

· 临床研究 ·

无创产前检测在慎用人群胎儿染色体非整倍体中的效能分析

李娜 琚端 王秀艳 翟春雅 龙英霞 马艳红 王秋霞 张颖 袁碧波 李晓洲

天津医科大学总医院妇产科 天津市女性生殖健康与优生重点实验室,
天津 300052

通信作者：袁碧波, Email: yuanbibotj@163.com, 电话: +86-15922184325

【摘要】 目的 分析无创产前检测 (noninvasive prenatal testing, NIPT) 在不同慎用人群胎儿染色体非整倍体筛查中的应用价值。方法 回顾性分析 2016 年 10 月至 2020 年 6 月期间在天津医科大学总医院妇产科自愿接受 NIPT 的 19 590 例孕妇资料, 比较 NIPT 在不同年龄、妊娠方式和胎儿数量中对胎儿染色体非整倍体的筛查效能。孕中期血清学筛查 (second trimester serum screening, STSS) 高风险和临界风险孕妇选择联合 NIPT 筛查, 同时对比分析 STSS、STSS 联合 NIPT 和直接 NIPT 3 种筛查技术的筛查效能。结果 NIPT 检测 21-三体、18-三体和 13-三体的阳性预测值分别为 87.18%、54.84%和 41.18%。NIPT 在高龄 (≥ 35 岁)、体外受精-胚胎移植和双胞胎妊娠孕妇中的灵敏度均为 100%, 特异度分别为 99.79%、99.82%和 100%, 阳性预测值分别为 85.25%、50.00%和 100%, 其中 ≥ 35 岁的阳性预测值显著高于 < 35 岁患者 (61.54%, $P=0.003$), 其余指标均与低龄 (< 35 岁)、自然受孕和单胎人群相似 (均 $P>0.05$)。与 STSS 相比, 联合筛查和直接 NIPT 筛查具有更高的阳性预测值 (1.20%、68.75%、73.74%, 均 $P<0.001$) 和更低的假阳性率 (27.83%、0.19%、0.17%, 均 $P<0.001$)。结论 NIPT 检测在高龄、STSS 高风险、体外受精-胚胎移植和双胞胎妊娠孕妇中对胎儿染色体非整倍体筛查具有较高的灵敏度、特异度和阳性预测价值, 能够缓解产前诊断的压力, 降低染色体病患儿的出生率。

【关键词】 无创产前检测; 血清学筛查; 高龄; 受精, 体外; 胚胎移植; 双胞胎妊娠

基金项目: 国家自然科学基金 (81901502)

Efficacy of noninvasive prenatal testing in fetal chromosome aneuploidy in cautious population

Li Na, Ju Duan, Wang Xiuyan, Zhai Chunya, Long Yingxia, Ma Yanhong, Wang Qiuxia, Zhang Ying, Yuan Bibo, Li Xiaozhou

Department of Gynecology and Obstetrics, General Hospital of Tianjin Medical University; Tianjin Key Laboratory of Female Reproductive Health and Eugenics, Tianjin 300052, China

Corresponding author: Yuan Bibo, Email: yuanbibotj@163.com, Tel: +86-15922184325

【Abstract】 Objective To analyze the application value of noninvasive prenatal testing (NIPT) in screening fetal chromosome aneuploidy in cautious population. **Methods** The data of 19 590 pregnant women who voluntarily received NIPT in the Department of Gynecology and Obstetrics, General Hospital of Tianjin Medical University from October 2016 to June 2020 were retrospectively analyzed. The patients were divided into groups according to age, type of pregnancy and number of fetuses. The screening efficiency of NIPT was compared among different groups. Meanwhile, the screening efficacy of second trimester serum screening (STSS), STSS combined with NIPT and direct NIPT screening was compared and analyzed. **Results** The positive predictive values of NIPT for trisomy 21, trisomy 18 and trisomy 13 were 87.18%, 54.84% and 41.18%, respectively. In pregnant women with advanced age (≥ 35 years old), *in vitro* fertilization and embryo transfer (IVF-ET) and twin pregnancy, NIPT sensitivity was all 100%, specificity was 99.79%, 99.82% and 100%, positive predictive value was 85.25%, 50.00% and 100%, respectively. The positive predictive value of ≥ 35 years old patients was significantly higher than that of < 35 years old patients (61.54%, $P=0.003$), and the other indicators were similar to those of the young (< 35 years old), conceived naturally and singleton group (all $P>0.05$). Compared with STSS, combined screening and direct NIPT screening had higher positive predictive value (1.20%, 68.75%, 73.74%; all $P<0.001$) and lower false positive rate (27.83%, 0.19%, 0.17%; all $P<0.001$). **Conclusion** NIPT has high sensitivity, specificity and positive predictive value for fetal chromosome aneuploidy screening in pregnant women with advanced age, STSS high risk, IVF-ET and twin pregnancy, which greatly relieves the pressure of prenatal diagnosis and reduces the birth rates of children with chromosome disease.

【Key words】 Noninvasive prenatal testing; Serological screening; Advanced maternal age; Fertilization *in vitro*; Embryo transfer; Twin pregnancy

Fund program: National Natural Science Foundation of China (81901502)

DOI: 10.3760/cma.j.cn101441-20220117-00027

收稿日期 2022-01-20 本文编辑 李天琦

引用本文: 周莹, 郭妍妍, 李岩, 等. X 射线辐射远端效应诱发小鼠卵巢储备功能下降的实验研究[J]. 中华生殖与避孕杂志, 2023, 43(7): 703-712. DOI: 10.3760/cma.j.cn101441-20220117-00027.

• 实验研究 •

X 射线辐射远端效应诱发小鼠卵巢储备功能下降的实验研究

周莹¹ 郭妍妍² 李岩¹ 叶舒婷¹ 张步美¹ 黎小佩¹ 王建梅¹

杜湧瑞¹

¹天津医科大学第二医院计划生育科&辅助生殖中心, 天津 300211; ²天

津医科大学第二医院放射治疗科, 天津 300211

周莹和郭妍妍对本文有同等贡献

通信作者: 杜湧瑞, Email: Gevin1971@tmu.edu.cn, 电话: +86-22-

88329315

【摘要】 目的 探讨 X 射线辐射远端效应(X-ray radiation-induced abscopal effects, X-RIAEs) 对小鼠卵巢储备的影响及可能的作用机制。方法 16 只动情周期规律的 6~8 周龄雌性 C57BL/6J 小鼠分为对照组和照射组, 8 只/组, 照射组小鼠麻醉后每日给予胸部局部区域 8 Gy X 射线照射, 连续照射 3 d, 对照组小鼠仅给予麻醉处理。照射结束 21 d 后, 检测两组小鼠动情周期、血清激素及促炎性因子水平、卵巢组织形态学变化; 利用转录组测序技术(ribonucleic acid sequencing, RNA-seq) 检测小鼠卵巢组织 RNA 转录组表达情况, 筛选差异表达基因(differentially expressed genes, DEGs) 后行基因本体论-生物学过程(gene ontology-biological processes, GO_BP) 分析, 通过应用实时荧光定量聚合酶链反应(real-time quantitative polymerase chain reaction, RT-qPCR) 验证测序结果, 免疫组织化学染色(immunohistochemistry, IHC) 检测精卵发生特异性碱性螺旋环螺旋蛋白 1(spermatogenesis-and oogenesis-specific basic helix-loop-helix-containing protein 1, SOHLH1) 和中性粒细胞弹性蛋白酶(neutrophil elastase, NE) 在卵巢组织内表达和定位情况。结果 照射组小鼠动情周期紊乱, 主要停滞于间期, 照射组小鼠始基卵泡数量[10.50(1.25, 12.75)]及生长卵泡数量[4.50(2.50, 9.00)] 均显著少于对照组小鼠[60.00(30.00, 90.25), $P<0.001$; 18.50(18.00, 20.75), $P<0.001$], 差异均具有统计学意义, 而闭锁卵泡数量[56.00(45.25, 98.75)]明显多于对照组[12.50(5.25, 20.25)], 差异具有统计学意义($P<0.001$); 照射组小鼠血清雌二醇水平[(70.28 ± 5.27) pmol/L]、抗苗勒管激素水平[(104.00 ± 6.98) μ g/L]均明显低于对照组小鼠[(97.58 ± 7.25) pmol/L, $P=0.016$; (129.70 ± 8.39) μ g/L, $P=0.046$], 而照射组小鼠卵泡刺激素水平与对照组小鼠相比, 差异无统计学意义($P=0.996$); 与对照组小鼠血清肿瘤坏死因子- α (tumor necrosis factor- α , TNF- α) 水平[(31.61 ± 12.89) μ g/L]、白细胞介素(interleukin, IL)-1 β 水平[(52.75 ± 2.06) μ g/L]相比, 照射组小鼠血清 TNF- α 水平[(488.30 ± 36.20)

μg/L] 和 IL-1β 水平 [(62.37±2.50) μg/L] 均明显升高 ($P<0.001$, $P=0.018$), 照射组小鼠血清 IL-6 水平较对照组小鼠也呈上升趋势, 但差异无统计学意义 ($P=0.301$)。GO_BP 分析结果显示, X-RIAEs 诱导小鼠卵巢组织表达下调的 DEGs 主要参与卵泡发育过程, 表达上调的 DEGs 主要参与卵巢组织炎症反应过程, RT-qPCR 结果与测序结果一致。IHC 结果显示, 照射组小鼠卵巢组织 SOHLH1 阳性表达面积 [(23.18±4.00) %] 显著低于对照组 [(65.90±6.28) %, $P=0.005$], 而 NE 阳性表达面积 [(30.73±4.00) %] 显著高于对照组 [(14.47±2.22) %, $P=0.024$]。结论 X-RIAEs 可诱发卵巢组织炎性反应, 并抑制小鼠卵巢卵泡生长及发育过程, 进而导致卵巢储备功能下降。

【关键词】 放射治疗; 卵巢储备; 生育力; 远端效应; 始基卵泡

基金项目: 天津医科大学第二医院青年科研基金 (2020ydey02)

Diminished ovarian reserve induced by X-ray radiation-induced abscopal effects in mice: an experimental study

Zhou Ying¹, Guo Yanyan², Li Yan¹, Ye Shuting¹, Zhang Bumei¹, Li Xiaopei¹, Wang Jianmei¹, Du Yongrui¹

¹ Department of Family Planning & Center for Reproductive Medicine, the Second Hospital of Tianjin Medical University, Tianjin 300211, China; ² Department of Radiation Oncology, the Second Hospital of Tianjin Medical University, Tianjin 300211, China

Zhou Ying and Guo Yanyan contributed equally to the article

Corresponding author: Du Yongrui, Email: gevin1971@tmu.edu.cn, Tel: +86-22-88329315

【Abstract】 Objective To investigate the effect and possible mechanism of the X-ray radiation-induced abscopal effects (X-RIAEs) on the ovarian reserve of mice. **Methods** Totally sixteen female C57BL/6J mice aged 6–8 weeks with regular estrous cycle were randomly divided into the sham group ($n=8$) and irradiation group ($n=8$). After anesthesia, the mice in the irradiation group were irradiated with 8 Gy X-ray on the local area of the chest every day for 3 d, while the mice in the sham group were not irradiated. After irradiation 21 d, the estrous cycle, serum hormones, serum pro-inflammatory factors, and ovarian morphological changes were detected. Ribonucleic acid sequencing (RNA-seq) was used to detect the expression of transcriptional levels in mouse ovarian tissues. The differentially expressed genes (DEGs) were screened and analyzed by gene ontology-biological process (GO_BP). Real-time quantitative polymerase chain reaction (RT-qPCR) verified the sequencing results. The expression and localization of spermatogenesis- and oogenesis-specific basic helix-loop-helix-containing protein 1 (SOHLH1) and neutrophil elastase (NE) in ovarian tissues were detected by immunohistochemistry (IHC). **Results** Compared with mice in the sham group, the irradiation group had a disordered estrous cycle, reduced primordial follicles [10.50 (1.25, 12.75) vs. 60.00 (30.00, 90.25), $P<0.001$] and growing follicles [4.50 (2.50, 9.00) vs. 18.50 (18.00, 20.75), $P<0.001$], significantly increased atretic follicles [56.00 (45.25, 98.75) vs. 12.50 (5.25, 20.25), $P<0.001$]. The levels of serum estradiol [(70.28±5.27) pmol/L] and anti-Müllerian hormone [(104.00±6.98) μg/L] in the irradiation group were significantly

lower than those in the sham group [(97.58±7.25) pmol/L, $P=0.016$; (129.70±8.39) μg/L, $P=0.046$], but the follicle-stimulating hormone (FSH) level in the irradiation group was not significantly different from that in the sham group ($P>0.05$). Compared with the sham group, the serum levels of TNF-α [(488.30±36.20) μg/L vs. (31.61±12.89) μg/L, $P<0.001$] and IL-1β [(62.37±2.50) μg/L vs. (52.75±2.06) μg/L, $P=0.018$] in the irradiation group were significantly increased, and the serum level of interleukin (IL)-6 in the irradiation group was also increased compared with the sham group, but the difference was not statistically significant ($P>0.05$). The results of GO_BP analysis showed that the down-regulated DGEs were mainly involved in the process of follicular development, and the up-regulated DGEs were involved in the inflammation process. The results of RT-qPCR were consistent with those of sequencing. The immunohistochemistry results showed that the positive expression area of SOHLH1 in the irradiation group [(23.18±4.00)%] was significantly lower than that of the sham group [(65.90±6.28)%, $P=0.005$], while the positive expression area of NE [(30.73±4.00)%] was significantly higher than that of the sham group [(14.47±2.22)%, $P=0.024$]. **Conclusion** X-RIAEs can induce an inflammatory reaction in ovarian tissue and inhibit the growth and development of ovarian follicles in mice, which leads to a decrease in ovarian reserve.

【Key words】 Radiotherapy; Ovarian reserve; Fertility; Abscopal effect; Primordial follicles

Fund program: Youth Scientific Research Fund of the Second Hospital of Tianjin Medical University (2020ydey02)

DOI: 10.3760/cma.j.cn101441-20220615-00261

收稿日期 2022-06-16 本文编辑 孙敏

引用本文: 谭丽, 赵培娟, 齐超凡, 等. 孕前扩展性携带者筛查在中国汉族育龄人群中的应用价值[J]. 中华生殖与避孕杂志, 2023, 43(7): 713-717. DOI: 10.3760/cma.j.cn101441-20220615-00261.

• 临床报道 •

孕前扩展性携带者筛查在中国汉族育龄人群中的应用价值

谭丽¹ 赵培娟² 齐超凡³ 程兰兰¹ 禹果¹ 赵冬梅¹ 宋玉霞¹ 项

云改¹ 梁雪琪¹ 彭默然¹

¹ 郑州大学第二附属医院生殖医学中心, 郑州 450014; ² 河南省平顶山

市妇幼保健院生殖中心, 平顶山 467000; ³ 郑州大学第二附属医院医

学影像科, 郑州 450014

通信作者: 谭丽, Email: litan668@126.com, 电话: +86-371-63974718

【摘要】 目的 探讨孕前扩展性携带者筛查 (preconception expanded carrier screening, PECS) 在中国汉族育龄人群中的临床应用价值。方法 回顾性研究 2019 年 9 月至 2022 年 5 月期间于郑州大学第二附属医院生殖医学中心采用序贯筛查模式进行 PECS 的不孕不育夫妇的基因检测结果, 对单基因病致病基因携带率、高危夫妇携带率及高危夫妇的临床结局进行统计和分析。结果 共有 1 565 例患者接受 PECS, 均为汉族人群, 其中接受扩展型 108 种单基因病检测的女性患者 420 例, 男性患者 84 例, 目标基因总体携带率为 30.75% (129/420)。检出 1 对高危夫妇, 携带率为 1.19% (1/84), 检测基因中携带率较高的分别是 *MMACHC* [2.58% (13/504)]、*ATP7B* [2.38% (12/504)]、*SLC22A5* [2.18% (11/504)]、*GALC* [1.79% (9/504)]、*PAH* [1.79% (9/504)]、*MLC1* [1.19% (6/504)], 余下均不足 1%。接受脆性 X 综合征 *FMR1* 基因检测的患者共 555 例, *FMR1* 基因突变 5 例, 占 0.90%, 对全突变患者直系亲属进行检测, 其母亲为前突变携带者 (CGG 重复数为 105)。接受脊髓型肌萎缩症 *SMM* 基因携带者筛查的患者共 502 例, 女性阳性携带者 14 例, 男性阳性携带者 2 例, 总体携带率为 3.19%。结论 单基因隐性遗传病在人群中携带率较高, 孕前进行筛查可以为患者提供优生优育指导, 选择胚胎植入前单基因遗传学检测 (preimplantation genetic testing for monogenic/single gene disorders, PGT-M) 和产前诊断, 可避免患儿的出生。

【关键词】 产前诊断; 携带者筛查; 胚胎植入前单基因遗传学检测

基金项目: 吴阶平医学基金会临床科研专项资助基金 (320.6750.18558 (9))

Application value of preconception expanded carrier screening in Chinese Han population of childbearing age

Tan Li¹, Zhao Peijuan², Qi Yuefan³, Cheng Lanlan¹, Yu Guo¹, Zhao Dongmei¹, Song Yuxia¹, Xiang Yungai¹, Liang Xueqi¹, Peng Moran¹

¹ Reproduction Medical Center of the Second Affiliated Hospital of Zhengzhou University, Zhengzhou 450014, China; ² Pingdingshan Maternal and Child Health Hospital in Henan Province, Center for Reproductive, Pingdingshan 467000, China; ³ Medical Imaging Department of the Second Affiliated Hospital of Zhengzhou University, Zhengzhou 450014, China

Corresponding author: Tan Li, Email: litan668@126.com, Tel: +86-371-63974718

【Abstract】 Objective To explore the clinical value of preconception expanded carrier screening (PECS) in Chinese Han population of childbearing age. **Methods** The gene detection results of infertile couples with PECS in the Reproductive Medicine Center of the Second Affiliated Hospital of Zhengzhou University from September 2019 to May 2022 were analyzed retrospectively. The

carrier rate of pathogenic gene, the detection rate of high-risk couples and the clinical outcome of high-risk couples were counted and analyzed. **Results** A total of 1 565 patients received PECS and they were all Chinese Han. A total of 504 patients received the 108 extended monogenic diseases testing, including 420 females and 84 males, the overall carrier rate of the target genes was 30.75% (129/420), and the detection rate of high-risk couples was 1.19% (1/84), the higher carrier rates of the tested genes were *MMACHC* [2.58% (13/504)], *ATP7B* [2.38% (12/504)], *SLC22A5* [2.18% (11/504)], *GALC* [1.79% (9/504)], *PAH* [1.79% (9/504)] and *MLC1* [1.19% (6/504)], the rest are less than 1%. There were 555 patients accepted *FMR1* gene detection, and 5 patients with *FMR1* gene mutation, accounting for 0.90%. Testing for direct relatives of patients with complete mutations, her mother is a pre mutation carrier with a CGG repeat count of 105. A total of 502 patients accepted *SMN1* gene testing. Totally 14 femals and 2 males were found to be *SMN1* gene carriers in this study, with a carrier rate of 3.19%. **Conclusion** The carryier rate of single gene recessive disorder is high in the population. Screening before pregnancy can provide birth health guidance for patients, help them to choose preimplantation genetic testing for monogenic/single gene disorders (PGT-M) and prenatal diagnosis, to avoid the birth of silk children.

【Key words】 Prenatal diagnosis; Carrier screening; Preimplantation genetic testing for monogenic/single gene disorders

Fund program: Special Fund for Clinical Research of Wu Jieping Medical Foundation(320.6750.18558(9))

DOI: 10.3760/cma.j.cn101441-20220813-00349

收稿日期 2022-10-13 本文编辑 孙敏

引用本文: 逯非凡, 李媛, 顾仲毅, 等. 孕酮对人孕晚期 DSCs 体外增殖及 *TNF-α*、*IL-6* 基因表达水平的影响[J]. 中华生殖与避孕杂志, 2023, 43(7): 718-722. DOI: 10.3760/cma.j.cn101441-20220813-00349.

• 临床报道 •

孕酮对人孕晚期 DSCs 体外增殖及 *TNF-α*、*IL-6* 基因表达水平的影响

逯非凡¹ 李媛² 顾仲毅¹ 李励¹ 杨倩倩¹ 徐畅¹ 邓轶方² 管睿¹

¹海军军医大学第一附属医院妇产科, 上海 200433; ²上海医药工业研究院有限公司药理评价研究中心, 上海 200437

逯非凡和李媛对本文有同等贡献

通信作者: 管睿, Email: cngreen785@163.com, 电话: +86-21-31162045

【摘要】 目的 研究孕激素对人孕晚期蜕膜基质细胞(decidual stromal cells, DSCs)形态、增殖以及分泌细胞因子的影响,从而探究孕激素在预防自发性早产中的作用机制。方法 人孕晚期 DSCs 原代培养并鉴定,培养液中加入不同浓度的孕酮,分成 10^{-6} mol/L 组、 10^{-5} mol/L 组和 10^{-4} mol/L 组,对照组培养液不加孕酮。显微镜下观察各组 DSCs 细胞形态、测量细胞长/宽比值;四甲基偶氮唑盐比色(methyl thiazolyl tetrazolium, MTT)法测定细胞增殖活性;RT-qPCR 检测肿瘤坏死因子- α (tumor necrosis factor- α , TNF- α)、白细胞介素-6(interleukin-6, IL-6)mRNA 表达水平。结果 ①DSCs 长/宽比值比较:孕酮 10^{-4} mol/L 组(5.87 ± 0.19)、 10^{-5} mol/L 组(5.98 ± 0.27)低于对照组(6.42 ± 0.19),差异有统计学意义($P < 0.001$, $P = 0.002$),孕酮 10^{-4} mol/L 组低于 10^{-6} mol/L 组(6.28 ± 0.32),差异有统计学意义($P = 0.005$)。②细胞增殖活性比较:孕酮 10^{-5} mol/L 组(0.70 ± 0.04)、 10^{-4} mol/L 组(0.78 ± 0.04)分别高于对照组(0.59 ± 0.05 ; $P = 0.027$ 、 $P = 0.002$), 10^{-4} mol/L 组高于 10^{-6} mol/L 组(0.61 ± 0.01 , $P = 0.004$)。③TNF- α mRNA 表达比较:孕酮各浓度组均低于对照组(均 $P < 0.001$), 10^{-5} mol/L 组、 10^{-4} mol/L 组均低于 10^{-6} mol/L 组(均 $P < 0.001$);IL-6 mRNA 表达比较:对照组、 10^{-6} mol/L 组、 10^{-5} mol/L 组和 10^{-4} mol/L 组中,IL-6 mRNA 表达水平逐渐降低,组间两两比较,差异均有统计学意义(均 $P < 0.001$)。结论 孕酮能使人孕晚期 DSCs 形态宽大饱满、促进细胞增殖、降低 TNF- α 及 IL-6 mRNA 表达水平,提示孕激素在预防自发性早产中起一定作用。

【关键词】 孕酮; 细胞增殖; 肿瘤坏死因子- α ; 白细胞介素-6; 蜕膜基质细胞

基金项目:上海市自然科学基金(13ZR1408600);上海老龄化和妇儿健康研究专项(2020YJZX0216)

Effects of progesterone on the proliferation and expressions of TNF- α and IL-6 genes of human decidual stromal cells in late pregnancy *in vitro*

Lu Feifan¹, Li Yuan², Gu Zhongyi¹, Li Li¹, Yang Qianqian¹, Xu Chang¹, Deng Yifang², Guan Rui¹

¹Department of Obstetrics and Gynecology, the First Affiliated Hospital, Naval Medical University, Shanghai 200433, China; ²Department of Pharmacology, Shanghai Institute of Pharmaceutical Industry, Shanghai 200437, China

Lu Feifan and Li Yuan contributed equally to the article

Corresponding author: Guan Rui, Email: cngreen785@163.com, Tel: +86-21-31162045

【Abstract】 Objective To study the effects of progesterone on the morphology, proliferation, and secretion of cytokines of human decidual stromal cells (DSCs) in late pregnancy, and to explore the mechanism of progesterone in preventing spontaneous preterm birth. **Methods** Human decidual stromal cells in late pregnancy were cultured and treated with different concentrations of progesterone (in the experimental groups, 10^{-6} mol/L, 10^{-5} mol/L and 10^{-4} mol/L progesterone was added to the culture medium respectively, and no progesterone was added to the culture medium of control group). The morphology of DSCs was

observed under the microscope, the cell length/width ratio was measured, the proliferation was detected by methyl thiazolyl tetrazolium (MTT) method, and the expressions of tumor necrosis factor- α (TNF- α) and interleukin-6 (IL-6) mRNA were detected by RT-qPCR. **Results** The length/width ratios of DSCs in progesterone 10^{-4} mol/L (5.87 ± 0.19) and 10^{-5} mol/L (5.98 ± 0.27) groups were lower than that in control group (6.42 ± 0.19), the differences were statistically significant ($P<0.001$, $P=0.002$). The length/width ratio in the 10^{-4} mol/L group was lower than that in the 10^{-6} mol/L group (6.28 ± 0.32 , $P=0.005$). The proliferation of DSCs in the 10^{-5} mol/L (0.70 ± 0.04) and 10^{-4} mol/L (0.78 ± 0.04) groups was higher than that in control group (0.59 ± 0.05 ; $P=0.027$, $P=0.002$), and proliferation of DSCs in 10^{-4} mol/L group was higher than that in 10^{-6} mol/L group (0.61 ± 0.01 , $P=0.004$). The expression of TNF- α mRNA in each progesterone group was lower than that in control group (all $P<0.001$) and the expression of TNF- α mRNA in the 10^{-5} mol/L and 10^{-4} mol/L groups was lower than that in the 10^{-6} mol/L group (all $P<0.001$). The expressions of IL-6 mRNA decreased gradually in control group, 10^{-6} mol/L, 10^{-5} mol/L and 10^{-4} mol/L groups, the differences were statistically significant (all $P<0.001$). **Conclusion** Progesterone can make the decidual stromal cells wider, promote proliferation, and decrease the expressions of TNF- α and IL-6 mRNA, which may play an important role in the mechanism of progesterone preventing spontaneous preterm birth.

【Key words】 Progesterone; Cell proliferation; Tumor necrosis factor- α ; Interleukin-6; Decidual stromal cells

Fund program: Natural Science Foundation of Shanghai (13ZR1408600); Shanghai Special Foundation for Research on Aging and Women's and Children's Health (2020YJZX0216)

DOI: 10.3760/cmaj.cn101441-20220520-00226

收稿日期 2022-06-02 本文编辑 王李艳

引用本文: 张剑, 陈小露, 王文博, 等. 男性染色体平衡易位携带者染色体断裂点与生精缺陷的关系初步探讨[J]. 中华生殖与避孕杂志, 2023, 43(7): 723-728. DOI: 10.3760/cmaj.cn101441-20220520-00226.

• 临床报道 •

男性染色体平衡易位携带者染色体断裂点与生精缺陷的关系初步探讨

张剑 陈小露 王文博 陈佳燕 葛运生

厦门大学附属妇女儿童医院（厦门市妇幼保健院）中心实验室，厦门

361003

通信作者: 葛运生, Email: gshee@163.com, 电话: +86-592-2662078

【摘要】 目的 分析男性染色体平衡易位携带者染色体及断裂点分布情况，并探讨不同断裂点对精子生成的影响。方法 采用回顾性研究收集 2015 年 1 月至 2021 年 12 月期间在厦门大学附属妇女儿童医院中心实验室行外周血 G-显带核型分析并确诊为染色体易位的 87 例男性患者的临床资料和精液常规及精子形态学检测数据，进一步结合文献综合分析。结果 87 例男性易位携带者中 37 例(42.53%)表现为精子生成缺陷。各条染色体受累数次不同，对精子生成的影响也不相同，1 号染色体受累多达 16 次，而 Y 和 18 号仅受累 1 次，4 例涉及性染色体的易位和 4 例复杂染色体重排均表现出生精功能缺陷；染色体易位共累计出现 122 个断裂点，其中有 14 个区带受累 3 次及以上，且不同断裂点对精子质量的影响也不同，易位发生在 Xq28 区带，临床上均表现为无精子症，发生在 19q13 区带 4 例中有 3 例有生精缺陷。结论 染色体平衡易位男性携带者中，精子生成情况差异较大，临床表现从精液正常到少、弱精子症甚至无精子症，其中 1 号染色体受累次数最多，且涉及 Xq28 区带的易位对精子生成的影响最为严重，均表现为无精子症。

【关键词】 核型分析； 染色体断裂点； 平衡易位； 生精缺陷

基金项目：厦门市医疗卫生科技项目（3502ZZ20194070）

A preliminary study on the relationship between chromosome breakpoint and spermatogenesis dysfunction in the male carriers of chromosomal balanced translocation

Zhang Jian, Chen Xiaolu, Wang Wenbo, Chen Jiayan, Ge Yunsheng

Department of Central Laboratory, Women and Children's Hospital, School of Medicine, Xiamen University (Xiamen Maternal and Child Healthcare Hospital), Xiamen 361003, China

Corresponding author: Ge Yunsheng, Email: gshee@163.com, Tel: +86-592-2662078

【Abstract】 Objective To determine the distribution of chromosomes and breakpoint regions in the male carriers of chromosomal balanced translocation, and to explore the influence of breakpoint regions on spermatogenesis. **Methods** A total of 87 male patients who underwent G-banding karyotype analysis and were diagnosed as translocation carriers in the Department of Central Laboratory of Women and Children's Hospital, School of Medicine, Xiamen University from January 2015 to December 2021, were included in a retrospective study. The clinical data and testing result of semen analysis and sperm morphology were collected and combined with the literature for comprehensive analysis. **Results** Spermatogenesis dysfunction was discovered in 37 of 87 (42.53%) male translocation carriers. The frequency of translocation varied from chromosome to chromosome, its influence on spermatogenesis was also different. Chromosome 1 occurred 16 times, but chromosome Y and 18 occurred only one time. Spermatogenesis dysfunction was observed in 4 cases. The 4 cases showed sex chromosomes translocation and complex chromosome rearrangement. A total of 122 breakpoint regions were identified. Among them, 14 chromosomal bands occurred 3 or more times. Different breakpoint regions had a different influence on the sperm quality. The carriers of Xq28 breakpoint were azoospermia. Spermatogenesis dysfunction occurred in 3 of 4 carriers involving band 19q13. **Conclusion** The results indicate genetic heterogeneity on spermatogenesis in the

male carriers of chromosomal balanced translocation. Clinical manifestations range from normal to oligozoospermia, asthenozoospermia or even azoospermia. Chromosome 1 is most frequently involved. The translocation of Xq28 has the most serious influence on spermatogenesis. All these carriers are diagnosed with azoospermia.

【 Key words 】 Karyotyping; Chromosome breakpoint; Balanced translocation; Spermatogenesis dysfunction

Fund program: Medical and Health Science and Technology Project (3502Z20194070)

DOI: 10.3760/cmaj.cn101441-20220218-00072

收稿日期 2022-02-22 本文编辑 宋培培

引用本文: 李嘉, 程章, Randy Polyanna Po, 等. 中国不孕症患者治疗动因及阻因的调查研究[J]. 中华生殖与避孕杂志, 2023, 43(7): 729-734. DOI: 10.3760/cmaj.cn101441-20220218-00072.

· 现场调查 ·

中国不孕症患者治疗动因及阻因的调查研究

李嘉¹ 程章² Randy Polyanna Po³ 郑祖庚³ Marie Markert⁴ 杨蕊¹

¹ 北京大学第三医院妇产科生殖医学中心 国家妇产疾病临床医学研究中心 (北京大学第三医院), 北京 100191; ² 北京大学第六医院临床研究室 北京大学精神卫生研究所 国家卫生健康委员会精神卫生学重点实验室 (北京大学) 国家精神心理疾病临床医学研究中心 (北京大学第六医院), 北京 100083; ³ 辉凌医药咨询 (上海) 有限公司, 上海 200122; ⁴ 辉凌制药公司, 哥本哈根 2300

通信作者: 杨蕊, Email: yrjeff@126.com, 电话: +86-10-82266625

【摘要】 目的 旨在调查中国不孕症患者或伴侣在不孕治疗过程中的感受、情绪、寻求治疗的动因和阻因。方法 2019年3月15日至5月17日期间在中国等9个国家开展一项针对不孕症患者和伴侣的在线横断面定量问卷调查, 共纳入1944名受访者, 其中257名中国受访者被纳入分析。本研究基于156例中国不孕症患者 (患者组) 和101例伴侣 (伴侣组: 不孕患者的伴侣) 的调查问卷对内容进行分析, 并按照纳入对象、性别、治疗结局不同采用韦尔奇检验和卡方检验进行组间比较。结果 257名被调查者年龄为(32.9±5.5)岁, 女性占比为49.8% (128/257)。

治疗过程中,患者组心理健康受影响的占比[83.3% (130/156)]显著高于伴侣组[72.3% (73/101), $P=0.034$]。患者组治疗相关的最常见情绪、身体症状影响分别为挫败感[27.5% (19/69)]、焦虑[27.5% (19/69)]和失眠症[44.9% (31/69)],伴侣组分别为焦虑[44.4% (12/27)]和情绪不稳定[55.6% (15/27)]。患者组和伴侣组最常见的治疗动因均为伴侣彼此的大力支持[37.0% (34/92), 51.1% (23/45), $P=0.126$]、认为花时间妊娠是值得的[33.7% (31/92), 55.6% (25/45), $P=0.017$]。最常见的就诊阻因为担心生育治疗对新生儿有影响[30.4% (7/23)]与伴侣对生孩子的渴望不相同[21.7% (5/23)]治疗费用昂贵[21.7% (5/23)]不知如何找到合适的医生[21.7% (5/23)]。结论 伴侣彼此的大力支持和值得投入时间治疗的信念是最常见治疗动因,担心生育治疗会对新生儿产生影响是最常见阻因。解决患者及其伴侣的心理健康具有重要意义。

【关键词】 不孕症; 感受; 情绪; 治疗动因; 治疗阻因

基金项目: 国家重点研发计划课题 (2021YFC2700605)

Investigation on the treatment motivations and barriers of infertility patients in China

Li Jia¹, Cheng Zhang², Po Randy Polyanna³, Zheng Zugeng³, Markert Marie⁴, Yang Rui¹

¹ Center for Reproductive Medicine, Department of Obstetrics and Gynecology, Peking University Third Hospital, Beijing 100191, China; ² Clinical Research Department, Peking University Sixth Hospital, Peking University Institute of Mental Health, NHC Key Laboratory of Mental Health (Peking University), National Clinical Research Center for Mental Disorders (Peking University Sixth Hospital), Beijing 100083, China; ³ Ferring Pharmaceuticals, Shanghai 200122, China; ⁴ Ferring Pharmaceuticals, Copenhagen 2300, Denmark

Corresponding author: Yang Rui, Email: yrjeff@126.com, Tel: +86-10-82266625

【Abstract】 Objective To understand the feelings and emotions of Chinese infertile patients and their partners on their journey of infertility treatment, and to understand their motivations and obstacles in seeking treatment. **Methods** An online cross sectional questionnaire survey on infertility patients and partners of infertile patients was conducted in 9 countries from March to May 2019. A total of 1 944 respondents participated in the study, in which 257 respondents from China were included in this analysis. The survey analyzed the perceptions and emotions of infertility patients (patient group) and partners (partner group: partner of infertile patients) on their journey of infertility treatment from their perspective. Based on the questionnaire on 156 Chinese infertility patients and 101 partners, this study analyzed and made a comparative analysis of the inter-group differences using Welch's test and χ^2 test based on different groups, genders and treatment outcomes. **Results** The average age of 257 respondents in China was (32.9±5.5) years, and the female respondents accounted for 49.8% (128/257). The proportion of mental health impacts of treatment journey in the patient group was significantly higher than that in the partner group [83.3% (130/156) vs. 72.3% (73/101), $P=0.034$]. The most common emotional and physical symptoms associated with fertility treatment were frustration [27.5% (19/69)], anxiety [27.5% (19/69)] and lack of sleep [44.9% (31/69)] in the patient group, anxiety [44.4% (12/27)] and emotional fluctuation

[55.6% (15/27)] in the partner group. The most common motivations for treatment in both patients and partners were the strong support of partner [37.0% (34/92) vs. 51.1% (23/45), $P=0.126$] and the belief that the time investment would be worth it to conceive a child [33.7% (31/92) vs. 55.6% (25/45), $P=0.017$]. Of respondents, the most common treatment consultation barriers were concerns about effects of fertility treatment on the newborn [30.4% (7/23)], partners having different desires for pregnancy [21.7% (5/23)], the high treatment cost [21.7% (5/23)] and couples didn't know how to find a suitable physician [21.7% (5/23)]. **Conclusion** The most common treatment driver is the strong support from partner and belief that the time investment would be worth it, concerns about effects of treatment on the newborn might be the most common barriers. It is of great significance to solve the psychological stress of patients and their partners.

【Key words】 Infertility; Feeling; Emotion; Treatment driver; Treatment barrier

Fund program: National Key Research and Development Program (2021YFC2700605)

DOI: 10.3760/cmaj.cn101441-20220421-00174

收稿日期 2022-04-26 本文编辑 王李艳

引用本文: 李超凤, 陈丹, 孔祥麟, 等. 接受 IVF-ET 治疗的夫妇中男性挫败感现状及其影响因素分析[J]. 中华生殖与避孕杂志, 2023, 43(7): 735-739. DOI: 10.3760/cmaj.cn101441-20220421-00174.

• 现场调查 •

接受 IVF-ET 治疗的夫妇中男性挫败感现状及其影响因素分析

李超凤 陈丹 孔祥麟 唐诗 伍雅琴 范瑛瑛

湖南师范大学医学院护理系, 长沙 410205

通信作者: 陈丹, Email: chengdang@126.com

【摘要】 目的 了解接受体外受精-胚胎移植 (*in vitro* fertilization and embryo transfer, IVF-ET) 治疗的夫妇中男性挫败感情况并分析其影响因素。方法 采取随机抽样的方法选取长沙生殖医学医院 2021 年 5 月至 2021 年 9 月期间收治的行 IVF-ET 治疗的 202 例男性患者作为研究对象。采用一般资料问卷、中文版挫败感量表、社会支持评定量表、Olson 婚姻质量问卷 (婚姻满意度、夫妻交流两个分量表)、抑郁自评量表、心理弹性量表进行调查。结果 202 例接受 IVF-ET 治疗的夫妇中男性挫败感的得分为 (16.25±9.93) 分; 多元线性回归分析显示: 婚姻状况、文化程度、婚姻质量中的夫妻交流、社会支持状况、抑郁情绪和心理弹性是接受 IVF-ET 治疗的夫妇中男性挫败感的主要影响因素 (均 $P<0.05$)。结论 接受 IVF-

ET 治疗的男性也有一定程度的挫败感，医护人员在关注接受 IVF-ET 女性心理状况的同时，也应当重视接受 IVF-ET 治疗挫败感较高的男性的心理健康并进行针对性的心理干预措施，从而缓解其挫败感，最终将有利于治疗结局。

【关键词】 受精，体外； 胚胎移植； 挫败感； 男性

基金项目：湖南师范大学医学院开放课题（KF2022029）；湖南省研究生科研创新项目（CX20210497）；湖南师范大学医学院教学改革重点项目（2022-2903）

Analysis of the current situation of defeat in men undergoing IVF-ET therapy and its influencing factors

Li Chaofeng, Chen Dan, Kong Xianglin, Tang Shi, Wu Yaqin, Fan Yingying

Department of Nursing, College of Medicine, Hunan Normal University, Changsha 410205, China

Corresponding author: Chen Dan, Email: chengdang@126.com

【Abstract】 Objective To investigate the defeat of men undergoing *in vitro* fertilization and embryo transfer (IVF-ET) and analyze its influencing factors. **Methods** A total of 202 male patients undergoing IVF-ET in Reproductive Medicine Hospital in Changsha from May 2021 to September 2021 were selected by random sampling. General data questionnaire, Chinese version of defeat scale, social support scale, Olson marital quality questionnaire (marital satisfaction, communication), self-rating depression scale, mental resilience scale were used. **Results** The defeat score of 202 men in IVF-ET was 16.25 ± 9.93 . Marital status, marital quality, education, communication, social support, depression and resilience were the main influencing factors of male defeat after IVF-ET (all $P < 0.05$). **Conclusion** Male who have received IVF-ET treatment also have a certain degree of defeat. While paying attention to the psychological status of women who have received IVF-ET, we should also pay attention to the psychological health of the male who have high defeat in IVF-ET treatment and carry out targeted psychological intervention measures to alleviate their defeat, which will be beneficial to the treatment outcome.

【Key words】 Fertilization *in vitro*; Embryo transfer; Defeat; Male

Fund program: Hunan Normal University Medical School Open Project (KF2022029); Hunan Graduate Research Innovation Project (CX20210497); Hunan Normal University School of Medicine Teaching Reform Key Project (2022-2903)

DOI: 10.3760/cma.j.cn101441-20220411-00156

收稿日期 2022-04-14 本文编辑 王李艳

引用本文：官华成，徐洁颖，徐步芳. 子宫内膜异位症患者孕激素抵抗的研究进展[J]. 中华生殖与避孕杂志, 2023, 43(7): 740-744. DOI: 10.3760/cma.j.cn101441-20220411-00156.

· 综述 ·

子宫内膜异位症患者孕激素抵抗的研究进展

官华成 徐洁颖 徐步芳

上海交通大学医学院附属瑞金医院妇产科, 上海 200025

通信作者: 徐步芳, Email: bufangxu@163.com, 电话: +86-13916992658

【摘要】 子宫内膜异位症(endometriosis, EMS)患者不孕症的发生率高达30%~50%, 常见的病因包括输卵管及盆腔因素、内分泌紊乱、卵子质量异常、炎症、免疫失调以及子宫内膜容受性低下。近年来研究表明, 子宫内膜孕激素抵抗与容受性低下密切相关, EMS患者子宫内膜孕激素受体(progesterone receptor, PR)表达下降、PRA/PRB失调、孕激素下游信号通路的多个分子表达异常、PR表观遗传学改变以及子宫内膜慢性炎症等因素造成子宫内膜对孕激素反应低下, 导致孕激素诱导的基因表达下降、雌孕激素调节的内膜容受性相关蛋白表达低下、子宫内膜结构改变、蜕膜化不足等, 最终胚胎着床失败。本文对EMS患者子宫内膜孕激素抵抗的发生机制及作用效应进行详细综述, 以期探索改善EMS患者子宫内膜容受性的治疗方法提供理论依据。

【关键词】 子宫内膜异位症; 孕激素抵抗; 子宫内膜; 胚胎植入

基金项目: 国家自然科学基金(82071712); 上海市“医苑新星”杰出青年医师人才项目(RC20210165)

Research progress of progesterone resistance in patients with endometriosis

Guan Huacheng, Xu Jieying, Xu Bufang

Department of Obstetrics and Gynecology of Ruijin Hospital, School of Medicine, Shanghai Jiao Tong University, Shanghai 200025, China

Corresponding author: Xu Bufang, Email: bufangxu@163.com, Tel: +86-13916992658

【Abstract】 The incidence of infertility in patients with endometriosis (EMS) is as high as 30%–50%, of which the common causes including the fallopian tube obstruction, pelvis adhesion, endocrine disorders, abnormal embryo quality, inflammation, immune disorders and impaired endometrial receptivity. Recent studies have shown that impaired endometrial receptivity is closely associated with progesterone resistance. Among patients with EMS, progesterone resistance may be the result of multiple factors including dysregulated expression of progesterone receptor (PR) and the ratio of PRA/PRB, aberrant expression of several molecules in the downstream of PR signaling pathways, epigenetic alterations, endometrial chronic inflammation and so on. And progesterone resistance can lead to decreased progesterone-induced gene expression, receptivity-related proteins, endometrial morphological changes and insufficient decidualization, which in turn causes impaired endometrial receptivity and embryo implantation failure. We reviewed the detailed mechanism of the occurrence and development of progesterone resistance in EMS patients, aiming to provide a theoretical basis for exploring the therapies for improving the endometrial receptivity of EMS patients.

【Key words】 Endometriosis; Progesterone resistance; Endometrium; Embryo implantation

Fund program: National Natural Science Foundation of China (82071712); "New Stars in Medical Garden" Talent Projection of Outstanding Young Doctors in Shanghai (RC20210165)

DOI: 10.3760/cmaj.cn101441-20220225-00083

收稿日期 2022-03-03 本文编辑 宋培培

引用本文: 王丽, 文宏贵, 谭长秀, 等. 经阴道超声引导下取卵术患者镇痛方式的研究进展[J]. 中华生殖与避孕杂志, 2023, 43(7): 745-751. DOI: 10.3760/cmaj.cn101441-20220225-00083.

· 综述 ·

经阴道超声引导下取卵术患者镇痛方式的研究进展

王丽 文宏贵 谭长秀 杨娜 兰灵 罗红

重庆医科大学附属妇女儿童医院生殖医学中心, 重庆 400013

通信作者: 罗红, Email: luohongcqfy@163.com, 电话: +86-23-63846879

【摘要】 经阴道超声引导下取卵术是体外受精-胚胎移植治疗不孕症中十分关键的核心步骤, 手术时间通常很短, 但穿刺针将刺破阴道壁和卵巢白膜, 在卵巢内进行操作仍会给患者带来不适和疼痛感。为缓解患者手术带来的痛苦, 减少不良反应发生, 临床与基础科研人员一直在研究探索更好、更满足患者期望的镇痛方式。本文就经阴道超声引导下取卵术镇痛方式研究进展进行综述。

【关键词】 镇痛; 麻醉; 取卵术

基金项目: 重庆市卫生健康委医学科研项目 (2022WSJK094)

Research progress in analgesic methods of patients undergoing transvaginal ultrasound guided oocyte retrieval

Wang Li, Wen Honggui, Tan Changxiu, Yang Na, Lan Ling, Luo Hong

Center for Reproductive Medicine, Women and Children's Hospital of Chongqing Medical University, Chongqing 400013, China

Corresponding author: Luo Hong, Email: luohongcqfy@163.com, Tel: +86-23-63846879

【Abstract】 Transvaginal ultrasound guided oocyte retrieval is a very critical core step in *in vitro* fertilization and embryo transfer treatment of infertility. The operation time is usually short, but the needle will pierce the vaginal wall and the

tunica albuginea of the ovary, and the operation inside the ovary can still cause discomfort and pain to the patient. In order to alleviate the pain caused by surgery and reduce the occurrence of adverse reactions, clinical and basic researchers have been researching and exploring better analgesia methods that meet the expectations of patients. This article reviews the research progress of analgesic methods in transvaginal ultrasound guided oocyte retrieval.

【Key words】 Analgesic; Anesthesia; Oocyte retrieval

Fund program: Chongqing Municipal Health Commission Medical Research Project (2022WSJK094)

DOI: 10.3760/cmaj.cn101441-20220309-00106

收稿日期 2022-03-14 本文编辑 王李艳

引用本文: 赫少菁, 李赛姣. 巨噬细胞在多囊卵巢综合征中的研究进展[J]. 中华生殖与避孕杂志, 2023, 43(7): 752-756. DOI: 10.3760/cmaj.cn101441-20220309-00106.

· 综述 ·

巨噬细胞在多囊卵巢综合征中的研究进展

赫少菁 李赛姣

武汉大学人民医院生殖医学中心 湖北省辅助生育与胚胎发育医学临床研究中心, 武汉 430060

通信作者: 李赛姣, Email: alva_whu@hotmail.com

【摘要】 多囊卵巢综合征 (polycystic ovary syndrome, PCOS) 是育龄妇女最常见的生殖和内分泌疾病之一, 其病因复杂, 发病机制至今未完全阐明。巨噬细胞与 PCOS 的发病机制、发病高危因素、重要临床特征等相关联, 其介导的低度慢性炎症被证实是 PCOS 发生发展的关键环节。本文就巨噬细胞在 PCOS 中的研究进展进行综述。

【关键词】 多囊卵巢综合征; 巨噬细胞; 巨噬细胞极化; 低度慢性炎症; 胰岛素抵抗

基金项目: 湖北省自然科学基金 (2022CFD155、2018CFB491); 国家自然科学基金青年基金 (81701412); 湖北省卫生健康科研基金 (WJ2021M158); 默克雪兰诺生殖医学基金 (MerckSerono_CREATE-2016141)

Research progress of macrophages in polycystic ovary syndrome

He Shaojing, Li Saijiao

Center for Reproductive Medicine, People's Hospital of Wuhan University; Hubei Clinical Research Center for Assisted Fertility and Embryo Development, Wuhan 430060, China

Corresponding author: Li Saijiao, Email: alva_whu@hotmail.com

【Abstract】 Polycystic ovary syndrome (PCOS) is one of the most common reproductive and endocrine diseases in women of childbearing age. Macrophages are associated with the pathogenesis, risk factors and important clinical features of PCOS. Low-grade chronic inflammation mediated by macrophages has been proved to be a key link in the occurrence and development of PCOS. This article reviewed the research progress of macrophages in PCOS.

【Key words】 Polycystic ovary syndrome; Macrophage; Macrophage polarization; Chronic low-grade inflammation; Insulin resistance

Fund program: Natural Science Foundation of Hubei Province (2022CFD155, 2018CFB491); National Natural Science Foundation of China for Youth (81701412); Health Research Foundation of Hubei Province (WJ2021M158); MerckSerono Reproductive Medicine Foundation (Merckserono_CREate-2016141)

DOI: 10.3760/cma.j.cn101441-20220318-00119

收稿日期 2022-03-27 本文编辑 孙敏

引用本文: 平昀鹭, 赵小萱, 冯晓玲. 逆转录转座子 LINE-1 介导配子和胚胎发育异常的研究进展[J]. 中华生殖与避孕杂志, 2023, 43(7): 757-762. DOI: 10.3760/cma.j.cn101441-20220318-00119.

· 综述 ·

逆转录转座子 LINE-1 介导配子和胚胎发育异常的研究进展

平昀鹭¹ 赵小萱¹ 冯晓玲²

¹黑龙江中医药大学研究生院, 哈尔滨 150040; ²黑龙江中医药大学附

属第一医院妇科二科, 哈尔滨 150040

通信作者: 冯晓玲, Email: doctorfxl@163.com

【摘要】 长散布核元件-1 (long interspersed nuclear element-1, LINE-1) 是人类基因组中唯一自主转座的非末端重复序列逆转录转座子, 能够复制并粘贴到基因组的新位点。为了确保进化成功, 可遗传的新 LINE-1 插入物在携带遗传信息的生殖细胞和胚胎干细胞中积累。然而, 早期胚胎发育中 LINE-1 抑制的减少可能会导致反转座子插入引起基因组突变, LINE-1 mRNA 和蛋白质表达增加可能通过诱导胎儿卵母细胞消耗、DNA 损伤与免疫炎症反应间接造成早期胚胎损伤乃至妊娠丢失。本文总结并分析了近年来关于 LINE-1 表观调控在配子发生及早期胚胎发育过程中的作用及其诱发早期自然流产的研究进展。

【关键词】 胚胎发育; 配子发生; 逆转录转座子; 长散布核元件-1; 早期自然流产

基金项目：国家自然科学基金面上项目（81973894、82174421）

Research progress of retrotransposon LINE-1 mediating abnormal gamete and embryo development

Ping Yunlu¹, Zhao Xiaoxuan¹, Feng Xiaoling²

¹ Graduate School of Heilongjiang University of Traditional Chinese Medicine, Harbin 150040, China; ² The Second Department of Gynaecology of the First Affiliated Hospital, Heilongjiang University of Traditional Chinese Medicine, Harbin 150040, China

Corresponding author: Feng Xiaoling, Email: doctorfxl@163.com

【Abstract】 Long interspersed nuclear element-1 (LINE-1) is the only self-transposable non-terminal repeat retrotransposon in the human genome, which can copy and paste to new sites in the genome. To ensure evolutionary success, heritable new LINE-1 inserts accumulate in germ cells and embryonic stem cells, which carry genetic information. However, the reduction of LINE-1 inhibition in early embryo development may lead to genomic mutations induced by reverse transposon insertion. Increased LINE-1 mRNA and protein expression may indirectly cause early embryo damage or even pregnancy loss by inducing oocyte wear, DNA damage and immune inflammatory response. This paper summarized and analyzed the research progress on the role of LINE-1 epigenetic regulation in gametogenesis and early embryo development and the causes of early pregnancy loss.

【Key words】 Embryonic development; Gametogenesis; Retrotransposon; Long interspersed nuclear element-1; Early spontaneous abortion

Fund program: General Program of National Natural Science Foundation of China (81973894, 82174421)

DOI: 10.3760/cma.j.cn101441-20220301-00090

收稿日期 2022-03-05 本文编辑 孙敏

引用本文：胡静怡，杨琰，姚桂东. 卵母细胞体外成熟技术发展现状及应用进展[J]. 中华生殖与避孕杂志, 2023, 43(7): 763-767. DOI: 10.3760/cma.j.cn101441-20220301-00090.

· 综述 ·

卵母细胞体外成熟技术发展现状及应用进展

胡静怡 杨琰 姚桂东

郑州大学第一附属医院生殖医学中心，郑州 450052

通信作者：姚桂东，Email: ygdzzu@163.com，电话：+86-371-67966173

【摘要】 卵母细胞体外成熟（*in vitro* maturation, IVM）技术是一种在体外诱导卵丘-卵母细胞复合物成熟到 MII 阶段的技术。为提高未成熟卵母细胞的 IVM

率, IVM 培养系统在发展中不断改进, 包括培养方案、培养液的改良及培养环境的优化, 并已发展出卵母细胞成熟率高于常规 IVM 培养方案的双期 IVM 培养方案, IVM 的临床妊娠率也得到了有效改善。IVM 因可避免卵巢过度刺激, 现已广泛应用于多囊卵巢综合征患者; 另也适用于有卵巢储备但对外源性促性腺激素无反应的卵巢抵抗综合征患者; 此外, IVM 还可与生育力保存技术结合, 适用于需进行生育力保存的癌症患者等。本文综述了 IVM 技术目前的发展现状及应用进展, 也为 IVM 未来方向做一简要概括。

【关键词】 卵母细胞; 体外成熟; 多囊卵巢综合征; 卵巢抵抗综合征; 生育力保存

基金项目: 国家自然科学基金(U1904138)

Development status and application progress of oocyte *in vitro* maturation technology

Hu Jingyi, Yang Guang, Yao Guidong

Center for Reproductive Medicine, the First Affiliated Hospital of Zhengzhou University, Zhengzhou 450052, China

Corresponding author: Yao Guidong, Email: ygdzzu@163.com, Tel: +86-371-67966173

【Abstract】 *In vitro* maturation (IVM) technology is a reproductive technology that induces the maturation of cumulus-oocyte complexes to the MII stage *in vitro*. Since the application of IVM technology, in order to improve the IVM rate of immature oocytes, the culture system has been continuously improved in the development, including the improvement of culture program and culture medium, and the optimization of culture environment, and a biphasic IVM protocol with higher oocyte maturation rate than conventional IVM protocol has been developed, with the effectively improvement of IVM clinical pregnancy rate. IVM technology has been widely used in patients with polycystic ovary syndrome to avoid ovarian hyperstimulation, and in patients with ovarian resistance syndrome who have ovarian reserve but do not respond to exogenous gonadotropins. Combined with a variety of fertility preservation technologies, it is also suitable for cancer patients who want fertility preservation. This view summarized the current development status and application progress of IVM technology, and makes a brief summary of the future direction of IVM.

【Key words】 Oocyte; *In vitro* maturation; Polycystic ovary syndrome; Resistance ovarian syndrome; Fertility preservation

Fund program: National Natural Science Foundation of China (U1904138)