

DOI: 10.13241/j.cnki.pmb.2014.04.011

## 基础卵泡刺激素水平对 IVF/ICSI-ET 超排卵周期卵巢反应的预测价值\*

张晓莉<sup>1,2</sup> 姚元庆<sup>1△</sup> 彭红梅<sup>1</sup> 王黎娜<sup>2</sup> 郭晓东<sup>3</sup> 王辉<sup>4</sup>

(1 解放军总医院妇产科 北京 100853; 2 武警总医院妇产科 北京 100049;

3 解放军第 302 医院 北京 100039; 4 北京石景山医院 北京 100043)

**摘要 目的:** 基础卵泡刺激素(bFSH)可以刺激精子生成和促进卵子成熟,是人体内重要的激素之一。本研究针对体外受精(IVF)周期 bFSH 水平的变化情况,探讨 bFSH 对卵巢反应的预测价值,为临床研究提供理论基础。**方法:** 回顾性分析 2012 年 1 月-2012 年 12 月在我院生殖医学中心接受体外受精-胚胎移植(IVF-ET)治疗的 154 例患者的临床资料,根据基础卵泡刺激素水平分为 A 组(bFSH $\geq$ 10 IU/L)、B 组( $8 \leq$  bFSH $\leq$ 10 IU/L)和 C 组(bFSH $<$ 8 IU/L)。对比分析三组对象的年龄、基础窦卵泡数(bAFC)、黄体生成素(LH)含量、FSH/LH 值、促性腺激素(Gn)的用量、使用时间、受精率及临床妊娠率等。**结果:** 三组患者的年龄、bAFC 及 FSH/LH 相比较,差异具有统计学意义( $P<0.05$ );三组的 Gn 用量和时间、获卵数及妊娠率比较,差异显著且具有统计学意义( $P<0.05$ );三组基础 LH 值及超排卵周期受精率无显著差异( $P>0.05$ )。**结论:** 基础卵泡刺激素(bFSH)对体外受精女性的卵巢储备功能具有一定的预测价值,bFSH 水平的高低可作为预测女性不孕患者超排卵周期卵巢反应性的一项重要指标,值得临床推广和应用。

**关键词:** 卵泡刺激素;体外受精;卵巢反应;促排卵

中图分类号:R711.6 文献标识码:A 文章编号:1673-6273(2014)04-643-03

## Prediction Values of bFSH on the Response to Ovary in the IVF/ICSI-ET Super Ovulation Cycle\*

ZHANG Xiao-li<sup>1,2</sup>, YAO Yuan-qing<sup>1△</sup>, PENG Hong-mei<sup>1</sup>, WANG Li-na<sup>2</sup>, GUO Xiao-dong<sup>3</sup>, WANG Hui<sup>4</sup>

(1 Department of Obstetrics and Gynecology, the General Hospital of PLA, Beijing, 100853, China;

2 Department of Obstetrics and Gynecology, the General Hospital of Armed Police, Beijing, 100049, China;

3 302 Hospital of PLA, Beijing, 100039, China;

4 Beijing Shi Jing Shan Hospital, Beijing, 100043, China)

**ABSTRACT Objective:** The basic follicle-stimulating hormone(bFSH) is one of the most important hormones in human body which could stimulate the production and maturity of sperm. This study aims to exploring the predictive value for ovarian response by means of observing the changes of bFSH levels during the *in vitro* fertilization (IVF) cycle so as to provide a theoretical basis for clinical research. **Methods:** A retrospective analysis was performed on the clinical data of 154 patients who were accepted the IVF-ET at the center of reproductive medicine in our hospital from January 2012 to December 2012. According to the bFSH levels, the selected patients were divided into three groups, namely, the group A (bFSH $\geq$ 10 IU/L); group B ( $8 \leq$  bFSH $\leq$ 10 IU/L) and group C (bFSH $<$ 8 IU/L). Then the age, the bAFC values, the time and dose of Gn, the rate of fertilization and pregnancy in three groups were compared and evaluated. **Results:** There were statistically significant differences about the age, the bAFC values, the rate of FSH and LH, the time and dose of Gn, the numbers of ovum and the rate of pregnancy ( $P<0.05$ ). But there was no statistically significant difference about the values of LH and the rate of fertilization in three groups ( $P>0.05$ ). **Conclusions:** It is indicated that the values of bFSH could predict the functions of women's ovary for those who were taken the *in vitro* fertilization and the levels of bFSH might become an essential item in the future for the clinical to detect the ovarian reactions of the infertile females during the super ovulation cycles.

**Key words:** Follicle-stimulating hormone; *In vitro* fertilization (ivf); Ovarian response; Stimulated ovulation

**Chinese Library Classification(CLC):** R711.6 **Document code:** A

**Article ID:** 1673-6273(2014)04-643-03

### 前言

近年来,体外受精-胚胎移植(*in vitro* fertilization-embryo

transfer, IVF-ET) 技术被广泛应用于不孕不育症的治疗中并取得了一定的效果。体外受精的成功率受多重因素的影响,若女性不孕患者的卵巢反应性差就会导致超排卵周期中排卵过少

\* 基金项目:国家自然科学基金青年科学基金项目(30901795)

作者简介:张晓莉(1983-),女,硕士研究生,主治医师,主要研究方向:妇产科及生殖医学等

△通讯作者:姚元庆, E-mail: laohushanshang@163.com

(收稿日期:2013-08-23 接受日期:2013-09-12)

甚至不排卵的现象发生,严重影响 IVF-ET 的成功率<sup>[1-3]</sup>。那么如何精确的评价卵巢的储备功能、针对不同的患者制定最佳的促排卵方案是目前临床生殖医学领域关注的热点问题。基础卵泡刺激素(bFSH)作为人体内重要的激素,作用于女性的卵巢可以促进卵泡颗粒层细胞的生殖和分化,促进卵子成熟。卵泡刺激素与卵巢排卵关系密切,基础卵泡刺激素的水平变化可反映卵巢的分泌功能<sup>[4-6]</sup>。有研究证实,bFSH 水平随着患者年龄的增加而升高,说明其对卵巢储备功能的预测更敏感<sup>[7]</sup>。我们通过研究 bFSH 对 IVF/ICSI-ET 超排卵周期卵巢反应的预测价值,力求科学全面的分析卵巢的储备功能,从而制定最佳治疗方案,为提高 IVF-ICSI-ET 的临床妊娠率提供参考。

## 1 资料与方法

### 1.1 研究对象

选取 2012 年 1 月 - 2012 年 12 月在我院生殖医学中心接受 IVF/ICSI-ET 的患者 154 例。年龄分布在 25-45 岁,平均年龄  $32.78 \pm 5.13$  岁;基础窦卵泡数 2-42 个,平均  $12.7 \pm 3.4$  个;不孕期限为 1-12 年,平均  $5.08 \pm 2.91$  年。不孕的原因:女性输卵管因素,如子宫内膜异位症、排卵障碍等;男性因素,如严重少弱精子症、无精子症及逆行射精等;其他因素,如多次人工授精失败等。根据基础 FSH 值,将所选病例分为三组,A 组:29 例,  $bFSH \geq 10$  IU/L;B 组:37 例,  $8 \text{ IU/L} \leq bFSH \leq 10 \text{ IU/L}$ ;C 组:88 例,  $bFSH < 8 \text{ IU/L}$ 。

### 1.2 方法

1.2.1 激素水平测定 分别于排卵周期前一经期的第二天及排卵后的第 13-15 天抽取患者静脉血。采用免疫化学发光法测定患者血清中的基础卵泡刺激素(bFSH)、LH、T、E<sub>2</sub>、垂体泌乳素(PRL)、人绒毛膜促性腺激素(hCG)等<sup>[8]</sup>。放射免疫分析药盒由北京北方生物技术研究所提供,组间变异及组内变异均  $< 5\%$ 。

1.2.2 促排卵方案 患者月经来潮后的 2-5 天行 B 超检查窦卵

泡数以排除卵巢囊肿;促排卵采用重组人促卵泡激素(r-FSH, 75-150 IU, 5.5  $\mu\text{g}/75 \text{ IU}$ , 生产批号: S20080030);根据卵泡发育情况调整用药剂量,当直径达 18 mm 的卵泡数超过两个时应采取皮下注射 10000 IU HCG;于第 34-36 经阴道 B 超行穿刺取卵<sup>[9]</sup>。

1.2.3 IVF-ET 常规行体外受精,18 小时后观察原核和极体等评价受精情况,第二、第三天观察胚胎情况;第三天细胞数达 6-10 个、卵裂球形态规则且碎片  $\leq 15\%$  的视为优质胚胎;胚胎移植后的 14 天,检测患者血常规及 hCG;第 28-35 天经 B 超检查可见孕囊、胚芽及原始心管搏动或手术病检证实为异位妊娠者均诊断为临床妊娠<sup>[10]</sup>。

### 1.3 观察指标

观察三组患者的年龄、基础卵泡刺激素 (bFSH)、窦卵泡 (AFC)、促黄体生成素 (LH)、卵泡刺激素与黄体生成素比值 (FSH/LH)、促性腺激素(Gn)的用量及使用时间、获卵数、受精率及临床妊娠率等。

### 1.4 统计学处理

采用 SPSS19.0 软件进行统计处理,计量资料采用方差分析,计数资料以百分率表示并用  $\chi^2$  检验,结果以均数  $\pm$  标准差 ( $\bar{X} \pm S$ ) 表示,以  $P < 0.05$  为差异具有统计学意义。

## 2 结果

### 2.1 三组患者的基本资料

如表 1 所示,A 组平均年龄为  $(35.38 \pm 5.47)$  岁;bAFC 为  $(5.31 \pm 3.54)$  IU/L;LH 为  $(4.87 \pm 1.70)$ ;FSH/LH 为  $(3.09 \pm 1.32)$ 。B 组平均年龄为  $(33.41 \pm 5.56)$  岁;bAFC 为  $(12.65 \pm 11.56)$  IU/L;LH 为  $(4.14 \pm 1.94)$ ;FSH/LH 为  $(2.79 \pm 1.82)$ 。C 组平均年龄为  $(31.67 \pm 4.40)$  岁;bAFC 为  $(15.28 \pm 15.45)$  IU/L;LH 为  $(4.17 \pm 2.85)$ ;FSH/LH 为  $(2.09 \pm 1.12)$ 。三组患者的基础 LH 值比较,无显著差异( $P > 0.05$ );年龄、bAFC 及 FSH/LH 比较差异明显,具有统计学意义( $P < 0.05$ )。

表 1 三组临床资料

Table 1 Clinical data of patients in three groups

| Group                       | Cycle(case) | Age(year)        | bAFC              | LH              | FSH/LH          |
|-----------------------------|-------------|------------------|-------------------|-----------------|-----------------|
| A( $\geq 10 \text{ IU/L}$ ) | 29          | $35.38 \pm 5.47$ | $5.31 \pm 3.54$   | $4.87 \pm 1.70$ | $3.09 \pm 1.32$ |
| B( $8-10 \text{ IU/L}$ )    | 37          | $33.41 \pm 5.56$ | $12.65 \pm 11.56$ | $4.14 \pm 1.94$ | $2.79 \pm 1.82$ |
| C( $< 8 \text{ IU/L}$ )     | 88          | $31.67 \pm 4.40$ | $15.28 \pm 15.45$ | $4.17 \pm 2.85$ | $2.09 \pm 1.12$ |

### 2.2 三组超排卵周期的卵巢反应情况

如表 2 所示,A 组 Gn 用量为  $(43.9 \pm 19.5)$  IU;使用时间为  $(10.17 \pm 3.81)$  天;获卵数为  $(8.10 \pm 5.35)$  个;受精率为 84%;临床

妊娠率为 20%。B 组 Gn 用量为  $(33.86 \pm 13.96)$  IU;使用时间为  $(10.92 \pm 4.14)$  天;获卵数为  $(12.51 \pm 8.71)$  个;受精率为 85%;临床妊娠率为 32%。C 组 Gn 用量为  $(33.40 \pm 12.37)$  IU;使用时间为  $(11.11 \pm 4.78)$  天;获卵数为  $(18.15 \pm 11.27)$  个;受精率为 88%;

表 2 三组患者基础 FSH 及超排卵周期卵巢反应

Table 2 Values of bFSH and reactions of the ovary in three groups

| Group                       | Gn level(IU)      | Time(day)        | Ovum               | Fertilization(%) | Pregnancy(%) |
|-----------------------------|-------------------|------------------|--------------------|------------------|--------------|
| A( $\geq 10 \text{ IU/L}$ ) | $43.90 \pm 19.50$ | $10.17 \pm 3.81$ | $8.10 \pm 5.35$    | 84               | 20           |
| B( $8-10 \text{ IU/L}$ )    | $33.86 \pm 13.96$ | $10.92 \pm 4.14$ | $12.51 \pm 8.71$   | 85               | 32           |
| C( $< 8 \text{ IU/L}$ )     | $33.40 \pm 12.3$  | $11.11 \pm 4.78$ | $118.15 \pm 11.27$ | 88               | 47           |
| P                           | 0.001             | $> 0.05$         | 0.000              | $> 0.05$         | $< 0.05$     |

临床妊娠率为 47%。由此可知, A 组 Gn 用量最多, 但获卵数最少、妊娠率最低; C 组 Gn 用量最少、使用时间最长, 但获卵数最多、妊娠率最高, 差异具有统计学意义( $P < 0.05$ )。

### 3 讨论

卵巢储备功能是指卵巢皮质内原始卵泡生长发育成为可受精卵母细胞的能力。bFSH 值、抑制素 B、AMH 及超声检查等是临床上常用的评估卵巢储备功能的指标<sup>[11,12]</sup>。Muasher 等<sup>[14]</sup>在 1988 年首次提出了 bFSH 水平对 IVF 周期卵巢反应性具有预测作用, 而且与 IVF 的临床妊娠率成负相关。相关研究显示, bFSH 水平高的年轻女性行 IVF 周期的取消率高, 但对症处理后仍会获得理想的妊娠率, bFSH 水平的高低与年龄小于 35 岁的不孕症患者的活婴出生率无明显相关性<sup>[18,19]</sup>。另有研究指出, 随着患者年龄的增长或 bFSH 水平的升高, 其获卵数、受精率及可移植胚胎数均不同程度的下降。因此, 将年龄与 bFSH 水平相结合用于预测卵巢反应性将获得更好的效果<sup>[15]</sup>。据相关文献报道, 随着 FSH 值的升高, 卵泡的发育及卵子的质量降低, 促排卵后卵巢的反应性也随之变差, 因而将患者的年龄与窦卵泡数结合对卵巢储备及 IVF 妊娠结局的预测效果更好<sup>[16]</sup>。结合本研究, 我们采用 Gn 促排卵, 分析 bFSH 与各种指标的相关性, 结果发现 bFSH 值与卵泡个数、Gn 用量、临床妊娠率呈负相关, 说明 bFSH 越高, 用药后卵泡个数越少, 妊娠率越低。此外, 我们还发现随着女性年龄的增长, 其卵巢反应性及卵母细胞质量都有所下降, 必然影响妊娠结局。bFSH 的测定方法简单, 但也存在一定局限性, 如基础 E2 水平的升高会通过负反馈抑制 bFSH 值, 影响 bFSH 对卵巢功能的判断<sup>[13,17]</sup>。由于基础 FSH 存在很大的周期性差异, 我们需要进行多次检验、重复化验结果并且排除药物干扰才能获得较稳定的真实的 bFSH 值。既往研究表明, 若综合多个指标对卵巢功能进行测定, 可获得更好的效果, 如利用 FSH 与 LH 的比值判断卵巢储备功能, 并加以合理的用药和个性化的促排卵方案, 以利于提高妊娠率, 特别是 bFSH 水平偏高患者的妊娠率<sup>[20]</sup>。

综上所述, 本研究表明基础 FSH 值可以预测 IVF/ICSI 卵巢的反应性, 从而制定最佳的刺激方案, 加强卵巢反应的敏感度, 提高体外受精的成功率。因此, bFSH 的水平变化情况可作为评估卵巢功能的重要指标之一, 值得临床推广。

### 参考文献(References)

- [1] Caserta D, Lisi F, Marci R, et al. Does supplementation with recombinant luteinizing hormone prevent ovarian hyperstimulation syndrome in down regulated patients undergoing recombinant follicle stimulating hormone multiple follicular stimulation for IVF/ET and reduces cancellation rate for high risk of hyperstimulation?[J]. *Gynecol Endocrinol*, 2011, 27(11): 862-866
- [2] Papanikolaou EG, Verpoest W, Fatemi H, et al. A novel method of luteal supplementation with recombinant luteinizing hormone when a gonadotropin-releasing hormone agonist is used instead of human chorionic gonadotropin for ovulation triggering: a randomized prospective proof of concept study[J]. *Fertil Steril*, 2011, 1, 95(3): 1174-1177
- [3] Shaltout A, Shohyab A, Youssef MA. Can dopamine agonist at a low dose reduce ovarian hyperstimulation syndrome in women at risk undergoing ICSI treatment cycles? A randomized controlled study[J]. *Eur*

- J Obstet Gynecol Reprod Biol*, 2012, 165(2): 254-258
- [4] Karimzadeh MA, Ahmadi S, Oskouian H, et al. Comparison of mild stimulation and conventional stimulation in ART outcome [J]. *Arch Gynecol Obstet*, 2010, 281(4): 741-746
- [5] Wisner A, Gonen O, Ghetler Y, et al. Monitoring stimulated cycles during in vitro fertilization treatment with ultrasound only-preliminary results[J]. *Gynecol Endocrinol*, 2012, 28(6): 429-431
- [6] 付敏, 钱卫平, 房尚华, 等. GnRH 拮抗剂在超促排卵中的应用[J]. *现代生物医学进展*, 2013, 13(21): 4117-4118, 4026
- Fu Min, Qian Wei-ping, Fang Shang-hua, et al. The Application of Gn-RH-antagonist to Mediate Ovarian Hyperstimulation [J]. *Progress in Modern Biomedicine*, 2013, 13(21): 4117-4118+4026
- [7] 田晓华, 陈冬丽, 刘华, 等. 逆行射精精子冷冻保存在宫腔内人工授精技术中的应用[J]. *现代生物医学进展*, 2012, 12(02): 304-306
- Tian Xiao-hua, Chen Dong-li, Liu Hua, et al. The Efficacy of Cryopreservation and Intrauterine Insemination of Retrograde Ejaculation Sperm[J]. *Progress in Modern Biomedicine*, 2012, 12(02): 304-306
- [8] 黄彦妮, 苏亮, 谭丽娟, 等. 促排卵周期中未破裂黄素化卵泡综合征与性激素的关系探讨[J]. *现代生物医学进展*, 2012, 12(03): 504-507, 488
- Huang Yan-ni, Su Liang, Tan Li-juan, et al. Analysis on the Relationship between Luteinized Unruptured Follicle Syndrome and Hormone in the Cycle of Ovulation Induction[J]. *Progress in Modern Biomedicine*, 2012, 12(03): 504-507, 488
- [9] Sills ES, Alper MM, Waish AP. Ovarian reserve screening in infertility: practical applications and theoretical directions for research E[J]. *Eur J Obstet Gynecol Reprod Biol*, 2009, 146(1): 30-36
- [10] Lukaszuk K, Liss J, Jakiel G. "Internal coasting" for prevention of ovarian hyperstimulation syndrome (OHSS) in IVF/ICSI[J]. *Ginek Pol*, 2011, 82(11): 812-816
- [11] Palomba S, Falbo A, Carrillo L, et al. Metformin reduces risk of ovarian hyperstimulation syndrome in patients with polycystic ovary syndrome during gonadotropin-stimulated in vitro fertilization cycles: a randomized, controlled trial[J]. *Fertil Steril*, 2011, 96(6): 1384-1390
- [12] Lin H, Wang W, Li Y, et al. Triggering final oocyte maturation with reduced doses of hCG in IVF/ICSI: a prospective, randomized and controlled study[J]. *Eur J Obstet Gynecol Reprod Biol*, 2011, 159(1): 143-147
- [13] Swanton A, Lighten A, Granne I, et al. Do women with ovaries of polycystic morphology without any other features of PCOS benefit from short-term metformin co-treatment during IVF? A double-blind, placebo-controlled, randomized trial [J]. *Hum Reprod*, 2011, 26(8): 2178-2184
- [14] Muasher S J, Oehninger S, Simonetti S, et al. The value of basal and or stimulated serum gonadotropin levels in prediction of stimulation response and in vitro fertilization outcome [J]. *Fertil&Steril*, 1988, 50(2): 298-307
- [15] Van Rooij I A J, Banesi L F J M M, Breekmans F J M, et al. Women older than 40 years of age and those with elevated follicle-stimulating hormone levels differ in poor response rate and embryo quality in in vitro fertilization[J]. *Fertil Steril*, 2003, 79(3): 482-488
- [16] Lee T H, Liu C H, Huang C C, et al. Impact of female age and nude infertility on ovarian reserve markers to predict outcome of assisted reproduction technology cycles [J]. *Reprod Biol Endocrinol*, 2009, 17(7): 100

(下转第 662 页)

- ment of melatonin and serotonin receptors [J]. *Rev Psychiatr Neurosci*, 2004, 29 (2): 126-133
- [10] Qi XL, Lin WJ, Li JF, et al. The depressive-like behaviors are correlated with decreased phosphorylation of mitogenactivated protein kinases in rat brain following chronic forced swimstress [J]. *Behav Brain Res*, 2006, 175 (2): 233-240
- [11] Berg KA, Harvey JA, Spampinato U, et al. Physiological and therapeutic relevance of constitutive activity of 5-HT 2A and 5-HT 2C receptors for the treatment of depression [J]. *Prog Brain Res*, 2008, 172(8): 287-305
- [12] Nishi K, Kanemaru K, Hasegawa S, et al. Both acute and chronic buspirone treatments have different effects on regional 5-HT synthesis in Flinders Sensitive Line rats (a rat model of depression) than in control rats [J]. *Neurochem Int*, 2009, 54(3-4): 205-214
- [13] Goodwin FK, Jamison KR. Manic-depressive illness [M]. New York: Oxford University press, 1990: 416-441
- [14] Jay TM, Rocher C, Hotte M, et al. Plasticity at hippocampal to prefrontal cortex synapses is impaired by loss of dopamine and stress: importance for psychiatric diseases [J]. *Neurotox Res*, 2004, 6(3): 233-244
- [15] 薛启冥. 神经系统的生理和病理化学 [M]. 北京: 科学出版社, 1992: 183-187
- Xue Qi-ming. The physiology and chemistry pathology of the nervous system [M]. Beijing: Science press, 1992: 183-187
- [16] Novati A, Roman V, Cetin T, et al. Chronically restricted sleep leads to depression-like changes in neurotransmitter receptor sensitivity and neuroendocrine stress reactivity in rats [J]. *Sleep*, 2008, 31(11): 1579
- [17] 陶明, 施慎逊, 顾牛范. 5-羟色胺受体的研究现状 [J]. *中华精神科杂志*, 1998, 31(3): 12
- Tao Ming, Shi Shen-xun, Gu Niu-fan. The research status of the 5-hydroxytryptamine receptor [J]. *Chinese Journal of Psychiatry*, 1998, 31(3): 12
- [18] Chen D B, Dai L X, Lai Y. Neural and endocrine mechanisms of depression induced by chronic stress [J]. *Journal of Chengdu Medical College*, 2007, 2(3-4): 212-215
- [19] Moret C, Briley M. The importance of norepinephrine in depression [J]. *Neuropsychiatr dis treat*, 2011, 7(11): 9-13
- [20] 姚芳传. 情感性精神障碍 [M]. 长沙: 湖南科学技术出版社, 1998: 75
- Yao Fang-chuan. Mood disorders [M]. ChangSha. Hunan Science and Technology Press, 1998: 75
- [21] Di chiara G, Loddo P, Tanda G. Reciprocal changes in prefrontal and limbic dopamine responsiveness to adverse and rewarding stimuli after chronic mild stress: implications for the psychobiology of depression [J]. *Biol psychiatry*, 1999, 46(12): 1624-1633
- [22] Banmann B, Peter D, Silvia D, et al. Tyrosine hydroxylase immunoreactivity in the locus coeruleus reduced in depressed nonsuicidal patients but normal in depressed suicide patients [J]. *European Archives of Psychiatry and Clinical Neuroscience*, 1999, 249(4): 212-219
- [23] 张峰, 曹仲伟, 张学杰, 等. 柴胡对大鼠慢性应激抑郁模型脑单胺类神经递质及其代谢物含量的影响 [J]. *山东中医药大学学报*, 2005, 3(29): 224-226
- Zhang Feng, Cao Zhong-wei, Zhang Xue-jie, et al. The effects of Radix Bupleuri on the brain monoamine neurotransmitters and their metabolites for the chronic stress depression model of rat [J]. *Journal of Shandong university of traditional Chinese medicine*, 2005, 3(29): 224-226

#### (上接第 645 页)

- [17] Chuang C C, Chen C D, Chao K H, et al. Age is a better predictor of pregnancy potential than basal follicle-stimulating hormone levels in women undergoing in vitro fertilization [J]. *Fertil Steril*, 2003, 79(1): 63-80
- [18] Melo M, Busso CE, Bellver J, et al. GnRH agonist versus recombinant HCG in an oocyte donation programme: a randomized, prospective, controlled, assessor-blind study [J]. *Reprod Biomed Online*, 2009, 19 (4): 486-492
- [19] 丁海珍, 于宝生. 促性腺激素抑制激素与生殖轴的关系 [J]. *现代生物医学进展*, 2010, 10(23): 4598-4600, 4597
- Ding Hai-zhen, Yu Bao-sheng. Relationship between Gonadotropin-inhibitory Hormone and Hypothalamus-Pituitary-Gonadal Axis [J]. *Progress in Modern Biomedicine*, 2010, 10(23): 4598-4600, 4597
- [20] 周立花, 李汶, 卢光琇. FSHR, LHR 基因突变与多态对女性生殖的影响 [J]. *现代生物医学进展*, 2010, 10(01): 186-189
- Zhou Li-hua, Li Wen, Lu Guang-xiu. The Influence of Gene Mutations and Polymorphism of FSHR and LHR to the Female Reproduction [J]. *Progress in Modern Biomedicine*, 2010, 10(01): 186-189