

doi: 10.13241/j.cnki.pmb.2019.23.035

电针结合红外线照射对反复着床失败患者子宫内膜容受性、胚胎移植及妊娠情况的影响*

赵萌¹ 柳榴² 权效珍¹ 兰艳丽¹ 田小龙¹ 吉志松¹ 杨学舟^{1Δ}

(1 湖北文理学院附属医院 / 湖北省襄阳市中心医院生殖医学中心 湖北 襄阳 441021;

2 武汉大学人民医院妇 III 科 湖北 武汉 430060)

摘要 目的:观察电针结合红外线照射对反复着床失败(RIF)患者子宫内膜容受性、胚胎移植及妊娠情况的影响。**方法:**选取 102 例于 2015 年 5 月-2018 年 5 月在我院行复苏胚胎移植的 RIF 患者,按照随机数字表法将患者分为电针结合红外线照射治疗组(A 组,38 例)、安慰针刺组(B 组,34 例)及空白对照组(C 组,30 例)。比较三组治疗前后血清雌二醇、孕酮水平,于治疗前后检测子宫内膜容受性超声学指标,包括子宫内膜厚度、内膜容积、血管血流指数(VFI)、内膜血流指数(FI)、阻力指数(RI),比较三组胚胎移植及妊娠情况。**结果:**三组治疗前后血清雌二醇、孕酮水平比较无统计学差异($P>0.05$)。治疗后 A 组子宫内膜厚度、内膜容积大于治疗前及 B 组、C 组,VFI、FI 高于治疗前及 B 组、C 组,RI 低于治疗前及 B 组、C 组($P<0.05$)。三组移植胚胎数、生化妊娠率、临床妊娠率比较无统计学差异($P>0.05$),A 组胚胎着床率高于 B 组、C 组($P<0.05$)。**结论:**电针结合红外线照射治疗 RIF 患者可以改善子宫内膜容受性,提高胚胎着床率。

关键词:电针;红外线照射;反复着床失败;子宫内膜容受性;妊娠

中图分类号:R711 文献标识码:A 文章编号:1673-6273(2019)23-4549-04

Effect of Electro-acupuncture Combined with Infrared Irradiation on Endometrial Receptivity, Embryo Transfer and Pregnancy in Patients with Repeated Implantation Failure*

ZHAO Meng¹, LIU Liu², QUAN Xiao-zhen¹, LAN Yan-li¹, TIAN Xiao-long¹, JI Zhi-song¹, YANG Xue-zhou^{1Δ}

(1 Reproductive Medicine Centre, Affiliated Hospital of Hubei Academy of Arts and Sciences/Xiangyang Central Hospital of Hubei Province, Xiangyang, Hubei, 441021, China; 2 Department of Gynecology III, People's Hospital of Wuhan University, Wuhan, Hubei, 430060, China)

ABSTRACT Objective: To observe the effect of electro-acupuncture combined with infrared irradiation on endometrial receptivity, embryo transfer and pregnancy in patients with repeated implantation failure (RIF). **Methods:** 102 RIF patients who underwent resuscitation embryo transfer in our hospital from May 2015 to May 2018 were selected. According to the random number table method, the patients were divided into electro-acupuncture combined with infrared irradiation treatment group (group A, 38 cases), placebo acupuncture group (group B, 34 cases) and blank control group (group C, 30 cases). The levels of serum estradiol and progesterone were compared before and after treatment among three groups, endometrial receptive ultrasound were measured before and after treatment, including endometrial thickness, endometrial volume, vascularization flow index (VFI), flow index (FI) resistance index (RI), embryo transfer and pregnancy were compared among three groups. **Results:** There was no significant difference in serum estradiol and progesterone levels among three groups before and after treatment ($P>0.05$). After treatment, the endometrial thickness, endometrial volume in group A were larger than those before treatment, group B and group C, VFI and FI were higher than those before treatment, group B and group C, RI was lower than those before treatment, group B and group C ($P<0.05$). There was no significant difference in the number of embryos transferred, biochemical pregnancy rate and clinical pregnancy rate among three groups ($P>0.05$), the implantation rate in group A was higher than that in group B and C ($P<0.05$). **Conclusion:** Electro-acupuncture combined with infrared irradiation can improve endometrial receptivity and embryo implantation rate in RIF patients.

Key words: Electro-acupuncture; Infrared irradiation; Repeated implantation failure; Endometrial receptivity; Pregnancy

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

Article ID: 1673-6273(2019)23-4549-05

* 基金项目:湖北省卫生计生委 2016-2017 年度中医药中西医结合科研一般项目(鄂卫生计生通 2017-20 号);

湖北省自然科学基金项目(2018CFB472)

作者简介:赵萌(1988-),女,硕士,住院医师,研究方向:生殖内分泌、不孕症及辅助生殖技术,E-mail: 18671019865@sina.com

Δ 通讯作者:杨学舟(1977-),女,博士,教授,主任医师,研究方向:生殖内分泌、不孕症及辅助生殖技术,E-mail: dryangxz@163.com

(收稿日期:2019-07-12 接受日期:2019-07-31)

前言

随着辅助生殖技术不断进步,"试管婴儿"成功率也不断提高,但仍有部分患者发生反复着床失败(repeated implantation failure, RIF),即反复、连续移植3次或3次以上优质胚胎,或累计移植10个或10个以上优质胚胎后仍未孕,RIF发生率约为10%^[1,2]。胚胎着床的过程受多方面影响,且胚胎是否能成功着床及正常发育与患者的子宫内膜容受性、胚胎质量等息息相关。在每个月经周期中,人子宫内膜可接受胚胎植入仅4-5天,植入失败是女性不育的主要原因,而无法实现子宫内膜容受性是造成生殖技术失败的主要原因^[3-5]。因此,提高体外受精-胚胎移植(IVF-ET)妊娠率的关键,在于如何改善子宫内膜的受容性^[6]。针灸可以调整气血、活络经脉,对于不孕不育的治疗可以起到事半功倍的效果,而且因其易操作,见效快,价格低等特点被越来越多的国家和地区接受,最重要的是无任何毒副作用^[7,8]。国内外对针灸在辅助生殖技术中的作用进行了大量研究,多数研究认为针灸可以明显提高RIF患者的妊娠率和活产率^[9,10],但是其作用机制尚未完全阐明。近年来,红外线照射因其显著

的热效应带来的改善局部血运的特殊效果也被用于治疗阳痿、盆腔炎等不孕不育相关疾病^[11]。本研究针对RIF患者,选取适当穴位行电针结合红外线照射治疗,观察此类患者复苏胚胎移植周期子宫内膜各项指标、妊娠结局的变化,现报道如下。

1 资料与方法

1.1 一般资料

选取102例于2015年5月-2018年5月在我院行复苏胚胎移植的RIF患者,本研究经我院伦理委员会批注通过。患者纳入标准:(1)年龄<38岁;基础血卵泡刺激素(blood follicle stimulating hormone, bFSH)<15 U/L;(2)超声检查子宫形态基本正常;(3)移植3次或3次以上优质胚胎后仍未孕。排除标准:(1)彩超检查卵巢囊肿者;(2)高血压、糖尿病、甲状腺功能亢进等内分泌疾病者;(3)宫腔镜检查内膜病变者。按照随机数字表法将患者分为电针结合红外线照射治疗组(A组,38例)、安慰针刺组(B组,34例)及空白对照组(C组,30例),三组一般资料见表1,三组bFSH、不孕年限、年龄、不孕类型、体质量指数等比较无统计学差异($P>0.05$),均衡可比。

表1 三组一般资料比较

Table 1 Comparison of general data among three groups

Groups	Age(years old)	Infertility years (years)	Infertility Types[n(%)]		Body mass index (kg/m ²)	bFSH(U/L)
			Primary	Secondary		
Group A(n=38)	32.57± 4.25	6.11± 1.62	18(47.37)	20(52.63)	21.84± 0.77	7.34± 2.08
Group B(n=34)	33.71± 4.22	6.40± 1.31	16(47.06)	18(52.94)	21.49± 1.18	7.46± 1.63
Group C(n=30)	32.10± 4.54	5.30± 1.75	14(46.67)	16(53.33)	21.66± 0.78	7.43± 1.75
F	1.102	0.829		0.279	1.506	0.271
P	0.274	0.412		0.598	0.137	0.788

1.2 研究方法

子宫内膜准备:所有患者均使用激素人工周期法准备内膜:自月经第3天开始口服戊酸雌二醇6 mg/d,10天后超声观察子宫内膜情况,若厚度>8 mm,加用黄体酮转化内膜准备胚胎移植。若厚度<8 mm,继续使用戊酸雌二醇直至内膜>8 mm。
① 电针结合红外线照射治疗组(A组):针刺穴位取归来、子宫、血海、地机快速进针,行针,得气后,连接电极线,采用疏密波(2/80 赫兹),强度选择患者能耐受的最大舒适强度。电针治疗的同时,下腹部(包括归来、子宫穴等处)予以红外线照射,30 min/次,月经干净后开始实施,隔日1次,直至胚胎移植前1天。
② 安慰针刺组(B组):安慰针刺点为非经非穴部位,腹部安慰针刺点为肚脐下3寸,旁开3寸(双侧);下肢安慰针刺点为足三里穴和阳陵泉穴连线的中点(双侧)。尽量舒张皮肤,缓慢进针,浅刺<5 mm,无得气,不行针,连接电针,但电针保持在"虚拟模式",即无电流刺激状态。将红外线照射仪对着患者下腹部,但不打开电源。
③ 空白对照组(C组):不接受针刺及红外线治疗。

1.3 观察指标

于治疗前后抽取三组空腹静脉血5 mL,采用3000 r/min的转速离心10 min,提取上清液,采用放射免疫分析法检测血

清雌二醇、孕酮水平。于治疗前后检测子宫内膜容受性超声学指标,包括子宫内膜厚度、内膜容积、血管血流指数(vascularization flow index, VFI)、内膜血流指数(flow index, FI)、阻力指数(resistance index, RI)。比较三组胚胎移植及妊娠情况。

1.4 统计学方法

采用SPSS23.0进行统计分析,采用[n(%)]表示计数资料,实施 χ^2 检验,采用($\bar{x} \pm s$)表示计量资料,实施t检验,多组间比较采用F检验,检验水准 $\alpha=0.05$,以 $P<0.05$ 为差异有统计学意义。

2 结果

2.1 三组性激素水平比较

三组治疗前后血清雌二醇、孕酮水平比较无统计学差异($P>0.05$),见表2。

2.2 三组子宫内膜容受性比较

三组治疗前内膜容积、子宫内膜厚度、VFI、FI、RI比较无统计学差异($P>0.05$),治疗后A组子宫内膜厚度、内膜容积大于治疗前及B组、C组,VFI、FI高于治疗前及B组、C组,RI低于治疗前及B组、C组($P<0.05$),见表3。

表 2 三组性激素水平比较($\bar{x} \pm s$)Table 2 Comparison of sex hormone levels among three groups($\bar{x} \pm s$)

Groups	Estradiol(pg/mL)		Progesterone(ng/mL)	
	Before treatment	After treatment	Before treatment	After treatment
Group A(n=38)	241.58± 57.81	238.68± 43.73	0.96± 0.33	0.95± 0.32
GroupB(n=34)	234.88± 61.18	236.15± 51.78	1.09± 0.23	1.05± 0.27
Group C(n=30)	245.83± 56.27	243.57± 56.49	1.07± 0.30	1.07± 0.28
F	0.478	0.225	1.917	1.473
P	0.634	0.823	0.083	0.141

表 3 三组子宫内膜容受性比较($\bar{x} \pm s$)Table 3 Comparison of endometrial receptive among three groups($\bar{x} \pm s$)

Groups	Endometrial thickness (mm)		Endometrial volume(mL)		VFI		FI		RI	
	Before	After	Before	After	Before	After	Before	After	Before	After
	treatment	treatment	treatment	treatment	treatment	treatment	treatment	treatment	treatment	treatment
Group A (n=38)	9.01± 1.54	11.12± 1.56*	3.68± 1.07	5.14± 1.31*	1.65± 0.61	2.19± 0.74*	24.55± 6.05	28.72± 7.35*	0.62± 0.12	0.43± 0.11*
GroupB (n=34)	8.96± 0.92	9.41± 1.14 [#]	3.65± 0.84	3.77± 1.03 [#]	1.71± 0.49	1.73± 0.56 [#]	24.32± 5.34	24.16± 5.07 [#]	0.63± 0.17	0.61± 0.09 [#]
Group C (n=30)	8.83± 1.17	9.18± 1.21 [#]	3.59± 0.81	3.72± 0.88 [#]	1.54± 0.67	1.61± 0.71 [#]	23.64± 4.29	24.44± 4.61 [#]	0.59± 0.13	0.58± 0.08 [#]
F	0.165	5.769	0.131	5.201	1.475	4.002	0.172	3.085	0.291	5.523
P	0.871	0.000	0.896	0.000	0.145	0.000	0.865	0.000	0.772	0.000

Note: Compared with before treatment, * $P<0.05$; Compared with group A, [#] $P<0.05$.

2.3 三组胚胎移植及妊娠情况比较

差异($P>0.05$),A 组胚胎着床率高于 B 组、C 组($P<0.05$),见表4。

三组移植胚胎数、生化妊娠率、临床妊娠率比较无统计学

表 4 三组胚胎移植及妊娠情况比较

Table 4 Comparison of embryo transfer and pregnancy among three groups

Groups	Number of embryos transferred(n)	Implantation rate[n(%)]	Biochemical pregnancy rate	Clinical pregnancy rate
			[n(%)]	[n(%)]
Group A(n=38)	1.78± 0.41	18(47.37)	19(50.00)	14(36.84)
GroupB(n=34)	1.89± 0.32	8(23.53) [#]	10(29.41)	6(17.65)
Group C(n=30)	1.77± 0.43	6(20.00) [#]	9(30.00)	5(16.67)
F	1.258	4.421	3.162	3.269
P	0.212	0.036	0.075	0.069

Note: Compared with group A, [#] $P<0.05$.

3 讨论

胚胎着床是一个多系统协作、极为复杂的生理过程,受到内分泌、免疫、生殖等多系统共同影响^[12,13]。子宫内膜容受性是指内膜允许囊胚粘附、穿透并植入而使胚胎着床的能力,此时也称为"植入窗口期"或"种植窗期",子宫内膜的容受性依赖于胚胎与子宫内膜的同步发育,同时包含了多种复杂的调控机制,只有这些方面因素均已具备,囊胚才能顺利的着床生长^[14-16]。对于子宫内膜容受性影响比较大的是子宫内膜厚度,评价子宫内膜容受性的指标包括子宫内膜细胞形态学的胞饮突,分子生物学指标如血管上皮生长因子、白血病抑制因子、整合素家族等,超声学中的内膜厚度、形态、内膜下血流,以及血清

雌二醇和孕酮水平等^[17,18]。本研究选取拥有优质胚胎的 RIF 患者的复苏移植周期,排除了胚胎及外源性激素的影响,从而针对子宫内膜容受性的改变来评价电针结合红外线照射的治疗价值。

较高的动脉血流阻抗影响局部组织血供必定会造成子宫内膜容受性的下降,给予电针及红外线干预后治疗组的患者较其他两组患者,以及较自身治疗前在子宫内膜的厚度、子宫内膜的血流是显著提高的,而动脉血流阻力是显著降低的,因此我们考虑电针可以通过机械刺激、电流改善盆腔微环境,增加子宫内膜血供、减轻子宫动脉阻抗^[19]。针刺可改善胞饮突的生长发育情况,促进整合素分子表达,从而达到提高临床妊娠率、提高子宫内膜容受性、改善子宫微环境的作用^[20,21]。且有研究^[22]

将针灸对子宫内膜容受性的影响与其它治疗方法作比较,结果证明单一针灸治疗或联合其他治疗方法对子宫内膜容受性有较好的改善作用,因其相对于中西药物及西医其他相关治疗来说,对机体有整体调节作用。

从中医辩证角度看,患者主要因为痰实、血淤、肾虚、血虚等导致内膜容受性较差,以虚为主,虚实交杂,所以中医治疗原则是活血化瘀、补肾养血、调经冲任^[23,24],这与西医子宫内膜下血流异常造成的子宫内膜容受性下降理论不谋而合。本研究以此理论为依据进行穴位选择:归来穴有活血化瘀,调经止痛,条血室,温下焦的作用;子宫穴有调经理气,升提下陷之功效;血海穴有化血为气,运化脾血,调经统血,健脾化湿之功效;地机穴对女性来说主要有健脾、调经之用,以上穴位配伍在移植前可以起到活血通络,增加子宫内膜容受性的功效^[25,26]。关于针刺治疗的安全性,Xu Z^[27]等人的研究证实针刺在体外受精过程中并不会影响母婴结局,如妊娠期糖尿病,妊娠期高血压,胎盘植入等。

此外,本研究还辅助红外线照射治疗,红外线具有非常显著的热效应,当身体局部受到红外线照射时,细胞分子运动加速,局部温度升高,可带来血管扩张、血流加速、改善局部组织的营养、代谢和血供的特殊效应^[28-30]。红外线照射结合电针疗法,同时从中西医的角度对女性整体的生殖功能以及子宫局部环境进行良性影响,结果显示治疗后患者的子宫内膜厚度、子宫内膜容积、子宫血流指数显著提高,动脉阻抗显著降低,胚胎着床率显著升高。虽然治疗干预后生化妊娠率、临床妊娠率改善并无统计学差异,但较未干预者明显升高,后期研究病例增加后这种趋势将更显著,需做进一步研究探讨。

综上所述,电针结合红外线照射治疗 RIF 患者可以改善子宫内膜容受性,提高胚胎着床率。

参考文献(References)

- [1] Chin TH, Hsu YC, Soong YK, et al. Obstetric and perinatal outcomes of pregnancy in patients with repeated implantation failure[J]. Taiwan J Obstet Gynecol, 2019, 58(4): 487-491
- [2] 张丽. 胚胎移植反复种植失败的原因及治疗研究进展[J]. 中国计划生育学杂志, 2017, 25(8): 559-562
- [3] Mohammadzadeh M, Ghorbani S, Nouri M. Evaluation of clinical utility of P53 gene variations in repeated implantation failure[J]. Mol Biol Rep, 2019, 46(3): 2885-2891
- [4] Mehrafza M, Kabodmehri R, Nikpour Z, et al. Comparing the Impact of Autologous Platelet-rich Plasma and Granulocyte Colony Stimulating Factor on Pregnancy Outcome in Patients with Repeated Implantation Failure[J]. J Reprod Infertil, 2019, 20(1): 35-41
- [5] 赵巧霞, 王宝金. 高强度聚焦超声子宫肌瘤消融术对子宫内膜容受性、性激素水平及妊娠结局的影响 [J]. 安徽医药, 2019, 23(5): 942-945
- [6] 戴菁, 黄增辉, 张硕屏, 等. 体外受精-胚胎移植中完全受精失败的原因分析[J]. 现代生物医学进展, 2017, 17(27): 5389-5391, 5395
- [7] Li T, Wang S, Zhang S, et al. Evaluation of clinical efficacy of silver-needle warm acupuncture in treating adults with acute low back pain due to lumbosacral disc herniation: study protocol for a randomized controlled trial[J]. Trials, 2019, 20(1): 470
- [8] 杨会生, 房慧恭, 李晓彤, 等. 针灸对体外受精-胚胎移植患者妊娠结局影响的随机对照试验系统评价[J]. 中华中医药杂志, 2017, 32(12): 5591-5598
- [9] 徐金龙, 杨增荣, 钱婧, 等. 分期针灸对 IVF-ET 反复移植失败患者子宫内膜厚度的影响[J]. 上海针灸杂志, 2018, 37(2): 200-204
- [10] Hsu YC, Liang IT, Huang SY, et al. Transcutaneous electrical acupoint stimulation (TEAS) treatment improves pregnancy rate and implantation rate in patients with implantation failure [J]. Taiwan J Obstet Gynecol, 2017, 56(5): 672-676
- [11] 郭竹英, 杨海艳, 李淑慧, 等. 活血生肌中药联合远红外线照射对自体动静脉内瘘的影响 [J]. 现代中西医结合杂志, 2019, 28(19): 2087-2090
- [12] Kolanska K, Suner L, Cohen J, et al. Proportion of Cytotoxic Peripheral Blood Natural Killer Cells and T-Cell Large Granular Lymphocytes in Recurrent Miscarriage and Repeated Implantation Failure: Case-Control Study and Meta-analysis [J]. Arch Immunol Ther Exp (Warsz), 2019, 67(4): 225-236
- [13] Hromadová L, Tokareva I, Veselá K, et al. Endometrial Receptivity Analysis - a tool to increase an implantation rate in assisted reproduction[J]. Ceska Gynekol, 2019, 84(3): 177-183
- [14] Lee CI, Wu CH, Pai YP et al. Performance of preimplantation genetic testing for aneuploidy in IVF cycles for patients with advanced maternal age, repeat implantation failure, and idiopathic recurrent miscarriage[J]. Taiwan J Obstet Gynecol, 2019, 58(2): 239-243
- [15] Khadem N, Mansoori M, Attaran M, et al. Association of IL-1 and TNF- α Levels in Endometrial Secretion and Success of Embryo Transfer in IVF/ICSI Cycles [J]. Int J Fertil Steril, 2019, 13 (3): 236-239
- [16] 魏苹, 张宜群, 赵珊琼. 中医药治疗子宫内膜容受性研究进展[J]. 新中医, 2018, 50(9): 25-28
- [17] 庄海娜, 钱婧, 杨泽冠, 等. 针灸改善子宫内膜容受性的临床研究特点分析[J]. 中医学报, 2019, 34(5): 1126-1130
- [18] Zhao DM, Shan YH, Li FH, et al. Correlation between endometrial receptivity with expressions of IL-1 and VEGF in rats with polycystic ovary syndrome [J]. Eur Rev Med Pharmacol Sci, 2019, 23 (13): 5575-5580
- [19] Ma S, Li D, Feng Y, et al. Effects of electroacupuncture on uterine morphology and expression of oestrogen receptors in ovariectomised rats[J]. Acupunct Med, 2017, 35(3): 208-214
- [20] 陈芊, 郝翠芳. 针灸对 IVF-ET 反复种植失败患者子宫内膜血流及胞饮突表达的影响[J]. 生殖与避孕, 2015, 35(3): 159-165
- [21] Cakmak YO, Akpınar IN, Yoldemir T. Decreasing the Uterine Blood Flow with Electroacupuncture: Bidermatomal and Monodermatomal Applications[J]. Gynecol Obstet Invest, 2017, 82(2): 151-156
- [22] 李哲郎, 王婉雪, 谢易冉, 等. 针灸改善子宫内膜容受性有效性 Meta 分析[J]. 中华生殖与避孕杂志, 2019, 39(3): 209-216
- [23] 夏宛延, 曾倩. 子宫内膜容受性不良的中医药对策[J]. 实用妇产科杂志, 2019, 35(2): 97-99
- [24] 刘卓, 董相丽, 连方, 等. 补肾中药对子宫内膜容受性影响的临床观察[J]. 世界中西医结合杂志, 2019, 14(2): 242-245
- [25] 林静, 陈晓红, 赵倩, 等. 针灸推拿治疗多囊卵巢综合征经穴规律分析[J]. 吉林中医药, 2017, 37(10): 1060-1063
- [26] 高志云, 罗国群, 高修安. 针刺结合中药周期疗法对 IVF-ET 失败患者不良子宫内膜容受性、胚胎种植率及妊娠率的影响[J]. 针灸临床杂志, 2019, 35(3): 31-34

- Spine Journal, 2018, 17(10): S126-S127
- [6] Diniz J M, Botelho R V. Is fusion necessary for thoracolumbar burst fracture treated with spinal fixation? A systematic review and meta-analysis[J]. J Neurosurg Spine, 2017, 27(5): 1-9
- [7] Sakitani N, Iwasawa H, Nomura M, et al. Mechanical Stress by Spasticity Accelerates Fracture Healing After Spinal Cord Injury[J]. Calcified Tissue International, 2017, 101(4): 384-395
- [8] Teunissen F R, Verbeek B M, Cha T D, et al. Spinal cord injury after traumatic spine fracture in patients with ankylosing spinal disorders [J]. J Neurosurg Spine, 2017, 27(6): 1-8
- [9] Isogai N, Asamoto S, Nakamura S, et al. Spine and Spinal Cord Injury Associated with a Fracture in Elderly Patients with Ankylosing Spondylitis[J]. Neurologia medico-chirurgica, 2017, 58(3): 103-109
- [10] Hibberd C S, Quan G. Risk Factors for Pathological Fracture and Metastatic Epidural Spinal Cord Compression in Patients With Spinal Metastases[J]. Orthopedics, 2017, 41(1): 1-8
- [11] Bourgetmurray J, Bassi M, Frederick A. Experimental study on pressure response to graded spinal canal compromise in an in vitro burst fracture mode[J]. Journal of Craniovertebral Junction & Spine, 2017, 8(2): 108-112
- [12] Ciriogliaro C M, Myslinski M J, Fountaine M F L, et al. Bone loss at the distal femur and proximal tibia in persons with spinal cord injury: imaging approaches, risk of fracture, and potential treatment options [J]. Osteoporosis International, 2017, 28(3): 747-765
- [13] Smits A J, Ouden L D, Jonkergouw A, et al. Posterior implant removal in patients with thoracolumbar spine fractures: long-term results[J]. European Spine Journal, 2017, 26(5): 1525-1534
- [14] Adiotomre E, Summers L, Allison A, et al. Diagnostic accuracy of DXA compared to conventional spine radiographs for the detection of vertebral fractures in children [J]. European Radiology, 2017, 27(5): 2188-2199
- [15] Martineau P, Leslie W D, Johansson H, et al. Clinical Utility of Using Lumbar Spine Trabecular Bone Score to Adjust Fracture Probability: The Manitoba BMD Cohort [J]. Journal of Bone & Mineral Research the Official Journal of the American Society for Bone & Mineral Research, 2017, 32(7): 1568-1574
- [16] Hartmann S, Tschugg A, Wipplinger C, et al. Analysis of the Literature on Cervical Spine Fractures in Ankylosing Spinal Disorders[J]. Global Spine Journal, 2017, 7(5): 469-481
- [17] Aleem I S, Demarco D, Drew B, et al. The burden of spine fractures in India: a prospective multicenter study [J]. Global Spine Journal, 2017, 7(4): 325-333
- [18] Rometsch E, Spruit M, Härtl R, et al. Does Operative or Nonoperative Treatment Achieve Better Results in A3 and A4 Spinal Fractures Without Neurological Deficit?: Systematic Literature Review With Meta-Analysis[J]. Global Spine J, 2017, 7(4): 350-372
- [19] Okada E, Tsuji T, Shimizu K, et al. CT-based morphological analysis of spinal fractures in patients with diffuse idiopathic skeletal hyperostosis[J]. Journal of Orthopaedic Science, 2017, 22(1): 3-9
- [20] Spiegl U, Jarvers J S, Heyde C E, et al. Osteoporotic vertebral body fractures of the thoracolumbar spine: indications and techniques of a 360° -stabilization [J]. European Journal of Trauma & Emergency Surgery, 2017, 43(1): 1-7
- [21] Meccariello L, Muzii V F, Falzarano G, et al. Dynamic corset versus three-point brace in the treatment of osteoporotic compression fractures of the thoracic and lumbar spine: a prospective, comparative study[J]. Aging Clinical & Experimental Research, 2017, 29(3): 1-7
- [22] Spiegl U J, Josten C, Devitt B M, et al. Incomplete burst fractures of the thoracolumbar spine: a review of literature [J]. European Spine Journal, 2017, 26(12): 1-12
- [23] Pariente E, Olmos J M, Landeras R, et al. Relationship between spinal osteoarthritis and vertebral fractures in men older than 50 years: data from the Camargo Cohort Study [J]. Journal of Bone & Mineral Metabolism, 2017, 35(1): 114-121
- [24] Zhao P, Wang S, Zhou Y, et al. MicroRNA-185 regulates spinal cord injuries induced by thoracolumbar spine compression fractures by targeting transforming growth factor- β 1[J]. Experimental & Therapeutic Medicine, 2017, 13(3): 1127-1132
- [25] Marek A P, Morancy J D, Chipman J G, et al. Long-Term Functional Outcomes after Traumatic Thoracic and Lumbar Spine Fractures[J]. Am Surg, 2018, 84(1): 20-27
- [26] Luther E, Urakov T, Vanni S. Percutaneous Instrumentation of a Complex Lumbar Spine Fracture with Bilateral Pedicle Dissociation: Case Report and Technical Note [J]. Journal of Neurological Surgery Part A Central European Neurosurgery, 2018, 79(05): 416-423
- [27] Kai K, Ikuta K, Masuda K, et al. Surgical Outcomes of Minimally Invasive Stabilization for Spinal Fractures in Patients with Ankylosing Spinal Disorders[J]. Asian Spine Journal, 2018, 12(3): 434-441
- [28] Rajanish R, Mohammed J, Chandhan M, et al. Arthroscopic Tibial Spine Fracture Fixation: Novel Techniques [J]. Journal of Orthopaedics, 2018, 15(2): 372-374
- [29] Adams A J, Talathi N S, Gandhi J S, et al. Tibial Spine Fractures in Children: Evaluation, Management, and Future Directions[J]. Journal of Knee Surgery, 2018, 31(05): 374-381
- [30] Bagga R S, Goregaonkar A B, Dahapute A A, et al. Functional and radiological outcomes of thoracolumbar traumatic spine fractures managed conservatively according to Thoracolumbar Injury Severity Score [J]. Journal of Craniovertebral Junction & Spine, 2017, 8(4): 369-373

(上接第 4552 页)

- [27] Xu Z, Chen W, Chen C, et al. Effect of intrauterine injection of human chorionic gonadotropin before frozen-thawed embryo transfer on pregnancy outcomes in women with endometriosis[J]. J Int Med Res, 2019, 47(7): 2873-2880
- [28] 王琴, 刘强. 加味苦参汤坐浴联合红外线照射对肛瘻术后伤口愈合的影响[J]. 吉林中医药, 2018, 38(9): 1064-1067
- [29] 黎作旭, 王尚全, 李长签. 针刀联合红外线照射治疗产后腰痛疗效观察[J]. 现代中西医结合杂志, 2018, 27(28): 3132-3134
- [30] 程晓明. 腺苷钴胺联合红外线理疗治疗中晚期妊娠带状疱疹神经痛疗效分析[J]. 中国医师杂志, 2010, 12(7): 998-999