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急性 ST 段抬高型心肌梗死患者直接介入治疗门 - 囊时间 及影响因素探讨

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摘要 目的:探讨在急性 ST 段抬高型心肌梗死(STEMI)患者中采用直接经皮冠状动脉介入治疗(PCI)方案所用的门 - 囊(D₂B)时间及其影响因素。**方法:**选取 2014 年 1 月至 2016 年 4 月我院收治的行 PCI 术治疗的 180 例 STEMI 患者为研究对象,经患者同意行介入治疗。记录患者院前延迟时间和 D₂B 时间。通过问卷调查患者的人口统计学资料、临床因素、疾病发生的背景及心理因素等相关资料。以 D₂B 时间 ≤ 126 min 为短 D₂B 组(n=96), >126 min 为长 D₂B 组(n=84),采用单因素与多因素 logistic 回归方法分析 D₂B 时间的影响因素。**结果:**所有患者 D₂B 时间的中位数为 126 min,仅有 26.7% 的患者 D₂B 时间控制在 90 min 以内;单因素分析显示,两组患者的突然发作、重视症状、发病时有人在场、症状进展快、节假日住院、入 CCU 时无症状、门诊就医、应用急救医疗服务体系(EMSS)转运、入 CCU 时间(6 am-10 pm)、梗前心绞痛及院前延误时间比较,差异有统计学意义(P<0.05);多因素 logistic 回归分析结果显示,节假日住院、门诊就医、入 CCU 无症状、重视症状、应用 EMSS 转运、入 CCU 时间(6 am-10 pm)等均为 D₂B 时间的影响因素(OR=2.62, 2.04, 1.59, 0.52, 0.28, 0.61, P<0.05)。**结论:**多数 STEMI 患者的 D₂B 时间均未达到指南要求,患者、医生、院内接诊机制等因素均与 D₂B 时间有关。

关键词:心肌梗死;经皮冠状动脉;介入治疗;门 - 囊时间

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Influencing Factors of Door-to-Balloon Time for Percutaneous Coronary Intervention in Patients with Acute ST-Segment Elevation Myocardial Infarction

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ABSTRACT Objective: To investigate the door-to-balloon (D₂B) time and its influencing factors for Percutaneous Coronary Intervention (PCI) in patients with acute ST-segment elevation myocardial infarction (STEMI). **Methods:** 180 cases of patients with STEMI in our hospital from January 2014 to April 2016 were selected. PCI therapy were operated on all patients after their consent. The pre-hospital delay time and D₂B time of the patients were recorded. The related information of the patients, including demographic data, clinical factors, background of the disease and psychological factors, were investigated by the questionnaire survey. The patients were divided into short D₂B group (D₂B time ≤ 126 min, n=96) and long D₂B group (D₂B time >126 min, n=84). Univariate and multivariate logistic regression methods were used to analyze the influencing factors of D₂B time. **Results:** The median D₂B time of all the patients was 126 min, and only 26.7% of patients' D₂B time controlled within 90 min. Univariate analysis showed that differences of sudden attack, pay attention to symptoms, someone was present when attack, symptoms progress was fast, in hospital during holiday, no symptom in CCU, outpatient treatment, transferred by emergency medical service system (EMSS), time in CCU (6 am-10 pm), angina before infarction and pre-hospital delay time between the two groups were statistically significant (P<0.05). Multivariate logistic regression analysis showed that in hospital during holiday, outpatient service, no symptom in CCU, pay attention to symptoms, use of transferred by EMSS, time in CCU (6am-10pm) are the factors affecting the time of D₂B (OR=2.62, 2.04, 1.59, 0.52, 0.28, 0.61 P<0.05). **Conclusion:** The D₂B time of most patients with STEMI can not reach the guidelines. The factors of patients, doctors, accepting mechanism of hospital are all related with D₂B time.

Key words: Myocardial infarction; Percutaneous coronary artery; Interventional therapy; The door-to-balloon time

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前言

急性 ST 段抬高型心肌梗死(ST-segment elevation myocardial infarction, STEMI) 是心内科常见的一种危急重症疾病,是由于急性血栓引起冠状动脉血流阻塞而导致局部心肌缺血性坏死的一组临床综合征,心电图表现可见明显的特征性动态变化,主要表现为受累心肌导联的 ST 段较正常状态明显抬高^[1]。采用直接经皮冠状动脉介入治疗(Percutaneous Coronary Intervention, PCI)方案治疗 STEMI 患者是目前的首选治疗方案,其通过快速开通梗死区域冠状动脉血管,对于恢复血供、挽救缺血心肌、改善心功能、降低患者死亡率方面效果显著^[2]。而研究发现,门-囊(door-to-balloon, D₂B)时间(患者入院至首次球囊扩张的时间)是影响 PCI 术效果的关键因素,对 STEMI 患者住院期间的死亡率及远期预后效果影响较大^[3,4]。美国心脏病学会/美国心脏协会(ACC/AHA)发布关于 STEMI 患者的治疗方案的实践指南中明确要求 D₂B 时间应控制在 90 min 内完成^[5],但大多数医院并未达到 D₂B 的时间要求。影响 D₂B 的因素很多,医生及患者因素均有影响。本研究旨在探讨 STEMI 患者的 D₂B 时间及相关影响因素,以期控制 D₂B 时间及提高 PCI 术的治疗效果提供线索与依据。

1 资料与方法

1.1 研究对象

收集 2014 年 1 月至 2016 年 4 月于我院入院行 PCI 术治疗的 180 例 STEMI 患者为研究对象,纳入标准:(1)症状和体征符合 STEMI 的诊断标准^[6];(2)发病时间为入院前 24h 或 12~24 h,且症状和体征具有心肌缺血与梗死的特征;(3)能清楚回答发病时的主要症状及时间。排除标准:(1)对本研究所用药物过敏者;(2)精神疾病患者;(3)对本研究方法 & 检查不依从者。其中,男性 98 例,女性 82 例,年龄 36~82 岁,平均年龄为(58.2±12.6)岁。本研究通过医院伦理委员会批准,患者均知情同意。

1.2 研究方法

1.2.1 介入治疗 患者入院后即行 300 mg 阿司匹林(拜耳医药保健有限公司,100 mg,批号:H20120236)嚼服,600 mg 氯吡格雷(杭州赛诺菲制药有限公司,75 mg,批号:H20056410)口服,GPIIb/IIIa 受体拮抗剂(欣维宁,中国远大医药有限公司,100 mL,批号:H20041165)遵医嘱使用。经患者签署直接 PCI 术的知情同意后,即行介入治疗。

1.2.2 问卷调查 采用自制统一的调查表对患者相关资料进行收集,调查人员为经过统一培训的医生及实习生,调查方式包括面对面询问及查阅病例档案两种。调查内容包括:(1)人口统计学资料,包括性别、年龄、职业、受教育程度、医疗状况等;(2)临床因素,包括家族史、既往病史、冠心病相关危险因素(如糖尿病、高血压、高血脂、吸烟等)、疾病情况(是否节假日入院、是否门诊就医、是否直接到院、入院时心功能、院前延迟时间、起病是否突然、症状进展如何、有无梗前心绞痛等)、入病房(CCU)时状况(时间、有无症状、是否采用急救医疗服务体系(EMSS)转运);(3)疾病发生的背景,包括是否有人在场;(4)心理因素,包括患者对症状的重视程度等。记录患者在院前延迟

的时间及 D₂B 时间。

1.3 观察指标

1.3.1 不同 D₂B 时间组患者基线资料的比较 以总的 D₂B 时间的中位数为标准,中位数以下的为短 D₂B 组,超过中位数的为长 D₂B 组。比较两组患者基线资料的差异。

1.3.2 D₂B 时间的影响因素分析 以 D₂B 时间为因变量,人口学资料、临床因素、疾病背景、心理因素等为自变量,进行单因素 logistic 回归分析;进一步以其他分组变量作为混杂因素纳入回归模型进行控制,分析调整后的危险因素。

1.4 统计学方法

采用 SPSS14.0 软件录入与整理数据,定量资料以($\bar{x} \pm s$)表示,两组符合正态分布、方差齐性的均数比较采用 t 检验;偏态分布资料以中位数(四分位数)表示,行秩和检验;定性资料以率(%)表示,采用 χ^2 检验,通过 Mann-Whitney U 秩和检验进行等级资料的分析。D₂B 时间的相关影响因素的分析采用单因素及多因素 logistic 回归分析进行。以 P<0.05 说明差异具有统计学意义。

2 结果

2.1 两组患者基本资料的比较

本次研究中,总的 D₂B 时间为 70~181 min,中位数为 126 min,因此以 D₂B≤126 min 为短 D₂B 组,>126 min 为长 D₂B 组。其中,短 D₂B 组的中位数为 98 min,长 D₂B 组的中位数为 162 min,仅有 26.7%的患者 D₂B 时间控制在 90 min 以内。

由表 1 可见,两组患者的年龄、性别、职业、受教育程度、医疗状况、家族史、既往病史、糖尿病、高血压、高血脂、吸烟、入院心功能、直接到院比例等基线资料比较,差异无统计学意义(P>0.05)。

2.2 影响 D₂B 时间的单因素分析

由表 2 所示,两组患者的突然发作、重视症状、发病时有人在场、症状进展快、节假日住院、入 CCU 时无症状、门诊就医、应用 EMSS 转运、入 CCU 时间(6 am-10 pm)、梗前心绞痛及院前延误时间比较,差异有统计学意义(P<0.05)。

2.3 影响 D₂B 时间的多因素分析

以表 2 中筛选的具有统计学差异的突然发作、重视症状、发病时有人在场、症状进展快、节假日住院、入 CCU 时无症状、门诊就医、应用 EMSS 转运、入 CCU 时间(6 am-10 pm)、梗前心绞痛及院前延误时间为混杂因素,采用多因素回归方法分析各变量调整后的危险性。结果如表 3 所示,节假日住院、门诊就医、入 CCU 无症状、重视症状、应用 EMSS 转运、入 CCU 时间(6 am-10 pm)等均为 D₂B 时间的影响因素,其中节假日住院、门诊就医、入 CCU 无症状为危险因素,而重视症状、应用 EMSS 转运、入 CCU 时间(6 am-10 pm)为保护因素。

3 讨论

STEMI 是临床常见的一类冠心病,具有起病急、进展快、并发症多和病死率高等特点,其主要病理变化为动脉粥样硬化或斑块的破裂,形成血栓,导致冠状动脉急性阻塞及心肌的缺血性坏死^[7]。因此,及早、完全、持久地开通梗死动脉(infarction related artery, IRA)、使心肌再灌注得以有效恢复,对减少患者

表 1 两组患者基线资料的比较

Table 1 Comparison of baseline datas in the patients of two groups

Variables		Short D ₂ B group (n=96)	Long D ₂ B group (n=84)	t/x ² /z	P
Age(years)		60.4± 12.0	57.9± 11.5	0.420	0.675
Gender(male/female,case)		50/46	48/36	0.462	0.497
Career[n(%)]	Worker	28(29.17)	26(30.95)	0.481	0.687
	Farmer	26(27.08)	23(27.38)		
	Civil servant	30(31.25)	29(34.52)		
	Others	12(12.50)	6(7.14)		
Education degree[n(%)]	Junior high school and below	35(36.46)	39(46.43)	2.007	0.367
	High school	22(22.92)	18(21.43)		
	University or above	39(40.63)	27(32.14)		
Medical service condition[n(%)]	Farmers health insurance	26(27.08)	23(27.38)	3.312	0.191
	Urban medical insurance	62(64.58)	59(70.24)		
	No insurance	8(7.08)	2(2.38)		
	Past medical history[n(%)]	12(12.50)	15(17.86)	1.008	0.315
	Family history[n(%)]	21(21.88)	15(17.86)	0.452	0.501
	Diabetes[n(%)]	20(20.83)	16(19.05)	0.089	0.765
High blood pressure[n(%)]		51(53.13)	40(47.62)	0.543	0.461
Hyperlipidemia[n(%)]		28(29.17)	21(25.00)	0.393	0.531
Smoking[n(%)]		43(44.79)	40(47.62)	0.144	0.704
Heart function on admission[n(%)]	I	51(53.13)	45(53.57)	0.007	0.997
	II	36(37.51)	31(36.90)		
	III	9(9.36)	8(9.52)		
	Straight to hospital[n(%)]	54(56.25)	51(60.71)	0.367	0.544
	Median of prehospital time(min)	112.00	156.00	16.052	0.015

表 2 影响 D₂B时间的单因素分析Table 2 Analysis of influencing factors of D₂B using single factor logistic

Variables	Short D ₂ B group(n=96)	Long D ₂ B group(n=84)	x ²	P
Sudden attack[n(%)]	74(77.08)	51(61.90)	5.657	0.017
Pay attention to symptoms[n(%)]	68(70.83)	37(44.05)	13.224	0.000
Someone was present when attack[n(%)]	72(75.00)	49(58.33)	5.648	0.017
Symptoms progress was fast[n(%)]	65(67.71)	44(52.38)	4.406	0.036
In hospital during holiday[n(%)]	25(26.04)	34(40.48)	4.236	0.040
No symptom in CCU[n(%)]	61(63.54)	32(38.10)	11.616	0.001
Outpatient treatment[n(%)]	8(8.33)	16(19.05)	4.451	0.035
Transferred by EMSS[n(%)]	49(51.04)	18(21.43)	16.813	0.000
Time in CCU[n(%)](6am-10pm)	76(79.17)	51(60.71)	7.343	0.007
Angina before infarction [n(%)]	61(63.54)	35(41.67)	8.613	0.003
Pre-hospital delay time[n(%)](>120min)	41(42.71)	51(60.71)	5.813	0.016

的心肌梗死面积,恢复心脏功能、及改善患者预后具有重要作用。目前 PCI 术是治疗 STEMI 的首选治疗策略^[8,9]。但该手术的

治疗效果具有严格的时间依赖。研究显示^[10],再灌注治疗的最佳时间窗为发病后的 6 h 内,但也有学者指出发病后的 2~4 h

表 3 影响 D₂B 时间的多因素分析Table 3 Analysis of influencing factors of D₂B using multiple factors logistic

Variables	Regression coefficient	P	OR	95%CI
In hospital during holiday	0.39	0.019	2.62	1.353-12
Outpatient treatment	0.67	0.014	2.04	1.29~2.90
No symptom in CCU	0.65	0.001	1.59	1.06~2.61
Pay attention to symptoms	-0.65	0.010	0.52	0.24~0.68
Transferred by EMSS	-1.62	0.001	0.28	0.19~0.47
Time in CCU(6 am-10 pm)	-0.81	0.001	0.61	0.24~0.80

内极易发生致命性心律失常,影响预后^[11]。因此 Ornato^[12]提出的“生存链”理论明确指出,尽早呼救、尽早行院前、院内评估和急救、尽早开通 IRA,能有效提高存活率、改善预后。然而研究发现,多数患者均存在不同程度的院前延误,且入院就诊至首次球囊扩张的时间(D₂B)也未达到指南要求的 90 min 以内^[13,14]。因此,本研究通过分析 D₂B 的时间长短及其相关影响因素,旨在为今后寻找控制 D₂B 时间的有效方案,提高 PCI 术治疗效果提供参考依据。

结果显示,D₂B 的中位数为 126 min,且患者中的 D₂B 时间仅有 26.7%控制在 90 min 以内。这与郭金成研究的 19.5%的结果接近^[15]。说明我国在 PCI 术治疗 STEMI 的 D₂B 时间上普遍长于指南标准。研究进一步应用单因素回归和多因素回归方法分析影响 D₂B 时间长短的相关因素,结果显示,节假日入院、通过门诊就医、入 CCU 时无症状、重视症状、采用 EMSS 转运病人、入 CCU 时间(6 am-10 pm)等因素均可影响 D₂B 的时间长短。说明,患者、医生及院内措施等相关因素均可能对 D₂B 的时间产生影响。其中,节假日住院、门诊就医、入 CCU 无症状为危险因素,可使 D₂B 的时间延长。原因可能与节假日值班医生及介入组成员少、门诊医生及患者本人对疾病不够重视或认识不够、由门诊入导管室时间及程序过长等因素有关。而重视症状、应用 EMSS 转运、入 CCU 时间(6 am-10 pm)为保护因素,可缩短 D₂B 时间。原因可能与患者对症状比较积极和关心、6 am-10 pm 入 CCU 时相关人员均在岗、EMSS 体系更快捷及人员更重视有关。这与以往的研究结果相符^[16-18]。提示,加强患者对疾病的认识及重视、确保节假日值班医生及介入组成员在岗、宣传使用应急医疗服务体系(EMSS)转运病人的重要性等措施均可有效减少 D₂B 时间的延误。

本研究结果发现,患者入院行 PCI 的程序一般为门诊(急诊)-CCU-导管室,这个过程中患者对医生所下的入 CCU 及行 PCI 的医嘱均有不同程度的决定时间,大大延误的治疗时机,而有研究指出,通过门-导管室途径将极大地缩短 D₂B 时间^[19,20]。因此,对院内 STEMI 患者的接诊流程进行调整和优化将极大的缩短 D₂B 的时间,提高 PCI 术效果。同时,应加强院内接诊医生及护士对 STEMI 的认识,告知患者及早手术的重要性,将大大增强患者的重视程度,减少延误时间。

综上,节假日住院、门诊就医、入 CCU 无症状、重视症状、应用 EMSS 转运、入 CCU 时间(6am-10pm)等因素均可可是 D₂B 时间的影响因素。从提高患者对疾病的认识、保证医生在岗及

改善患者接诊流程等方面均可有效缩短 D₂B 时间。

参考文献(References)

- [1] Rinta-Kiikka I, Tuohinen S, Ryymin P, et al. Correlation of electrocardiogram and regional cardiac magnetic resonance imaging findings in ST-elevation myocardial infarction: a literature review[J]. Ann Noninvasive Electrocardiol, 2014, 19(6): 509-523
- [2] Bennin CK, Ibrahim S, Al-Saffar F, et al. Achieving timely percutaneous reperfusion for rural ST-elevation myocardial infarction patients by direct transport to an urban PCI-hospital [J]. J Geriatr Cardiol, 2016, 13(10): 840-845
- [3] Savage ML, Poon KK, Johnston EM, et al. Pre-hospital ambulance notification and initiation of treatment of ST elevation myocardial infarction is associated with significant reduction in door-to-balloon time for primary PCI[J]. Heart Lung Circ, 2014, 23(5): 435-443
- [4] McCabe JM, Armstrong EJ, Hoffmayer KS, et al. Impact of door-to-activation time on door-to-balloon time in primary percutaneous coronary intervention for ST-segment elevation myocardial infarctions: a report from the Activate-SF registry[J]. Circ Cardiovasc Qual Outcomes, 2012, 5(5): 672-679
- [5] Puymirat E, Ducrocq G. Comparison between European Society of Cardiology (ESC) and American College of Cardiology/American Heart Association (ACC/AHA) guidelines for initial management of ST-elevation myocardial infarction (STEMI)[J]. Ann Cardiol Angeiol (Paris), 2013, 62(4): 265-268
- [6] 沈卫峰.《急性 ST 段抬高型心肌梗死诊断和治疗指南》解读[J]. 国际心血管病杂志, 2010, 37(6): 321-323
Shen Wei-feng. Appraisal of Chinese guideline of diagnosis and treatment: of acute ST-segment elevation myocardial infarction [J]. International journal of cardiovascular disease, 2010, 37(6): 321-323
- [7] 王慧娟,秦俭,万云高,等.初发急性 ST 段抬高心肌梗死患者预后的影响因素分析[J]. 现代生物医学进展, 2015, 15(29): 5651-5654
Wang Hui-juan, Qin Jian, Wan Yun-gao, et al. Analysis of Prognosis Influence Factors in Patients with Initial Onset ST-segment Elevation Myocardial Infarction [J]. Progress in Modern Biomedicine, 2015, 15 (29): 5651-5654
- [8] Weipert KF, Bauer T, Nef HM, et al. Use and outcome of thrombus aspiration in patients with primary PCI for acute ST-elevation myocardial infarction: results from the multinational Euro Heart Survey PCI Registry[J]. Heart Vessels, 2016, 31(9): 1438-1445
- [9] Koul S, Andell P, Martinsson A, et al. Delay from first medical contact to primary PCI and all-cause mortality: a nationwide study of patients

- with ST-elevation myocardial infarction[J]. J Am Heart Assoc, 2014, 3(2): e000486
- [10] Brown KA, Lambert LJ, Brophy JM, et al. Impact of ECG findings and process-of-care characteristics on the likelihood of not receiving reperfusion therapy in patients with ST-elevation myocardial infarction: results of a field evaluation [J]. PLoS One, 2014, 9(8): e104874
- [11] Franco JJ, Brown M, Bashir R, et al. Acute anterior ST-elevation myocardial infarction and electrical storm secondary to nondominant right coronary artery occlusion [J]. Tex Heart Inst J, 2014, 41(3): 335-337
- [12] Ornato JP. The ST-segment-elevation myocardial infarction chain of survival[J]. Circulation, 2007, 116(1): 6-9
- [13] Brennan AL, Andrianopoulos N, Duffy SJ, et al. Trends in door-to-balloon time and outcomes following primary percutaneous coronary intervention for ST-elevation myocardial infarction: an Australian perspective[J]. Intern Med J, 2014, 44(5): 471-477
- [14] Fan CM, Lai CL, Li AH, et al. Shorter Door-to-Balloon Time in ST-Elevation Myocardial Infarction Saves Insurance Payments: A Single Hospital Experience in Taiwan [J]. Acta Cardiol Sin, 2015, 31(2): 127-135
- [15] 郭金成, 马长生, 许敏, 等. 急性 ST 段抬高心肌梗死患者急诊介入治疗门 - 囊时间及其影响因素 [J]. 中国介入心脏病学杂志, 2010, 18(1): 21-24
- Guo Jin-cheng, Ma Chang-sheng, Xu Min, et al. Influencing factors of door-to-balloon time for Percutaneous Coronary Intervention in patients with acute ST segment elevation myocardial infarction [J]. Chin J Intervent Cardiol, 2010, 18(1): 21-24
- [16] Imori Y, Akasaka T, Shishido K, et al. Prehospital Transfer Pathway and Mortality in Patients Undergoing Primary Percutaneous Coronary Intervention[J]. Circ J, 2015, 79(9): 2000-2008
- [17] Nallamothu BK, Normand SL, Wang Y, et al. Relation between door-to-balloon times and mortality after primary percutaneous coronary intervention over time: a retrospective study[J]. The Lancet, 2015, 385(9973): 1114-1122
- [18] Peterson MC, Syndergaard T, Bowler J, et al. A systematic review of factors predicting door to balloon time in ST-segment elevation myocardial infarction treated with percutaneous intervention [J]. Int J Cardiol, 2012, 157(1): 8-23
- [19] Lee CH, Ooi SB, Tay EL, et al. Shortening of median door-to-balloon time in primary percutaneous coronary intervention in Singapore by simple and inexpensive operational measures: clinical practice improvement program[J]. J Interv Cardiol, 2008, 21(5): 414-423
- [20] Wang YC, Lo PH, Chang SS, et al. Reduced door-to-balloon times in acute ST-elevation myocardial infarction patients undergoing primary percutaneous coronary intervention [J]. Int J Clin Pract, 2012, 66(1): 69-75

(上接第 5065 页)

- [12] Ra HJ, Kim HS, Choi JY, et al. Comparison of the ceiling effect in the Lysholm score and the IKDC subjective score for assessing functional outcome after ACL reconstruction [J]. Knee, 2014, 21(5): 906-910
- [13] Everhart JS, Best TM, Flanigan DC. Psychological predictors of anterior cruciate ligament reconstruction outcomes: a systematic review [J]. Knee Surg Sports Traumatol Arthrosc, 2015, 23(3): 752-762
- [14] Paschos NK, Howell SM. Anterior cruciate ligament reconstruction: principles of treatment[J]. EFORT Open Rev, 2017, 1(11): 398-408
- [15] Herzog MM, Marshall SW, Lund JL, et al. Cost of Outpatient Arthroscopic Anterior Cruciate Ligament Reconstruction Among Commercially Insured Patients in the United States, 2005-2013 [J]. Orthop J Sports Med, 2017, 5(1): 2325967116684776
- [16] Sonnery-Cottet B, Thaunat M, Freychet B, et al. Outcome of a Combined Anterior Cruciate Ligament and Anterolateral Ligament Reconstruction Technique With a Minimum 2-Year Follow-up [J]. Am J Sports Med, 2015, 43(7): 1598-1605
- [17] Bucher TA, Naim S, Mandalia V. The use of the 70° arthroscope for anatomic femoral and tibial tunnel placement and tunnel viewing in anterior cruciate ligament reconstruction [J]. Arthrosc Tech, 2014, 3(1): e79-e81
- [18] Michalitsis S, Vlychou M, Malizos KN, et al. Meniscal and articular cartilage lesions in the anterior cruciate ligament-deficient knee: correlation between time from injury and knee scores [J]. Knee Surg Sports Traumatol Arthrosc, 2015, 23(1): 232-239
- [19] Myer GD, Ford KR, Di Stasi SL, et al. High knee abduction moments are common risk factors for patellofemoral pain (PFP) and anterior cruciate ligament (ACL) injury in girls: is PFP itself a predictor for subsequent ACL injury?[J]. Br J Sports Med, 2015, 49(2): 118-122
- [20] 张太良, 张磊, 廉志明, 等. 关节镜下前交叉韧带重建保留残端与否则干预膝关节本体感觉功能恢复的 Meta 分析 [J]. 中国组织工程研究, 2017, 21(3): 471-477
- Zhang Tai-liang, Zhang Lei, Lian Zhi-ming, et al. Effect of remnant preservation on recovery of knee proprioception in arthroscopic anterior cruciate ligament reconstruction: a meta-analysis[J]. Chinese Journal of Tissue Engineering Research, 2017, 21(3): 471-477
- [21] Taylor BJ, Waxman PJ, Richter SJ, et al. Evaluation of the effectiveness of anterior cruciate ligament injury prevention programme training components: a systematic review and meta-analysis[J]. Br J Sports Med, 2015, 49(2): 79-87
- [22] Aly AR, Rajasekaran S, Mohamed A, et al. Feasibility of ultrasound-guided percutaneous tenotomy of the long head of the biceps tendon--Apilot cadaveric study [J]. J Clin Ultrasound, 2015, 43(6): 361-366
- [23] Yazdi H, Moradi A, Sanaie A, et al. Does the hyperextension maneuver prevent knee extension loss after arthroscopic anterior cruciate ligament reconstruction?[J]. J Orthop Traumatol, 2016, 17(4): 327-331
- [24] Devgan A, Rohilla R, Singh A, et al. A prospective study to evaluate the clinico-radiological outcomes of arthroscopic single bundle versus double bundle anterior cruciate ligament reconstruction[J]. J Clin Orthop Trauma, 2016, 7(Suppl 2): 236-242
- [25] Trocan I, Ceausu RA, Jitariu AA, et al. Healing Potential of the Anterior Cruciate Ligament Remnant Stump [J]. In Vivo, 2016, 30(3): 225-230