doi: 10.13241/j.cnki.pmb.2020.22.016

支架置入术治疗椎动脉起始段狭窄的临床疗效及术后支架内再狭窄的影响因素分析*

姜海波[1] 王小姗[2△] 曹 辉[1] 龚凯琳[3] 陈奇琦[4]

（1南京医科大学附属脑科医院脑血管病救治中心 江苏 南京 210029;2南京医科大学附属脑科医院神经内科 江苏 南京 210029;
3南京医科大学附属脑科医院物理诊断科 江苏 南京 210029;4南京医科大学附属脑科医院脑磁图室 江苏 南京 210029）

摘要 目的:研究支架置入术(SI)治疗椎动脉起始段狭窄(VAOS)的临床疗效及术后支架内再狭窄(ISR)的影响因素。**方法:**选择从2018年1月到2020年2月在我院接受SI治疗的VAOS患者83例纳入本次研究。剔除1例手术失败及1例死亡患者的病例后,对剩余81例患者根据患者是否发生ISR,将其分成ISR组28例和无ISR组53例。随访分析患者的临床疗效,对患者发生ISR进行单因素及多因素Logistic回归分析,同时分析患者美国国立卫生院卒中量表(NIHSS)评分与血管狭窄情况及血流动力学指标的相关性。**结果:**83例VAOS患者接受SI术式治疗后,手术成功率为98.80%(82/83)。术后有3例患者发生动脉痉挛,另有1例患者在术后7 d由于继发脑出血而死亡,并发症的总发生率为4.82%(4/83)。ISR组的高脂血症、合并颈内动脉的狭窄、椎动脉的狭窄部位为双侧、支架类型为裸支架的比例分别高于无ISR组(均$P<0.05$)。根据Pearson法分析相关性显示,患者NIHSS评分与血管狭窄率、狭窄血管长度、收缩期峰值流速(PSV)和舒张期末流速(EDV)均呈正相关($P<0.05$)。根据Logistic回归分析显示,患者发生ISR影响因素包含高脂血症和支架类型为裸支架,以及合并颈内动脉的狭窄和并发双侧椎动脉的狭窄($P<0.05$)。**结论:**SI术式治疗的VAOS患者的临床疗效较好,且术后ISR的影响因素主要包含高脂血症和支架类型为裸支架,以及合并颈内动脉的狭窄和并发双侧椎动脉的狭窄,临床上应引起相应的重视。

关键词:支架置入术;椎动脉起始段狭窄;临床疗效;术后;支架内再狭窄;影响因素

中图分类号:R743 **文献标识码:**A **文章编号:**1673-6273(2020)22-4274-05

Clinical Efficacy of Stent Implantation in the Treatment of Vertebral Artery Origin Stenosis and the Influence Factors of Postoperative In-stent Restenosis*

JIANG Hai-bo[1], WANG Xiao-shan[2△], CAO Hui[1], GONG Kai-lin[3], CHEN Qi-qi[4]

*(1 Cerebrovascular Disease Treatment Center, Brain Hospital Affiliated to Nanjing Medical University, Nanjing, Jiangsu, 210029, China;
2 Department of Internal Medicine-Neurology, Brain Hospital Affiliated to Nanjing Medical University, Nanjing, Jiangsu, 210029, China;
3 Department of Physical Diagnosis, Brain Hospital Affiliated to Nanjing Medical University, Nanjing, Jiangsu, 210029, China;
4 Magnetoencephalogram room, Brain Hospital Affiliated to Nanjing Medical University, Nanjing, Jiangsu, 210029, China)*

ABSTRACT Objective: To study the clinical efficacy of stent implantation (SI) in the treatment of vertebral artery origin stenosis (VAOS) and the influencing factors of postoperative in-stent restenosis (ISR). **Methods:** 83 VAOS patients who were received SI treatment from January 2018 to February 2020 were included in this study. After excluding 1 case of failed operation and 1 case of death, the remaining 81 patients according to whether they had ISR incidence were divided into ISR group with 28 cases and no ISR group with 53 cases. The patient's clinical efficacy was follow-up analyzed, single factor and multivariate logistic regression analysis was used to analyze the ISR incidence. The correlation between National Institutes of Health Stroke Scale(NIHSS) score and vascular stenosis and hemodynamic indexes were analyzed. **Results:** 83 VAOS patients received SI surgical after treatment, the success rate of operation was 98.80% (82/83). There were 3 patients with arterial spasm, and 1 patient died of secondary cerebral hemorrhage 7 d after operation, the total incidence rate of complications was 4.82% (4/83). The proportion of hyperlipidemia, internal carotid artery stenosis, bilateral vertebral artery stenosis and stent type as bare stent in ISR group were higher than those in non ISR group (all $P<0.05$). According to Pearson analysis, NIHSS score was positively correlated with stenosis rate, stenosis vessels length, peak systolic velocity (PSV) and end diastolic velocity (EDV) ($P<0.05$). According to Logistic regression analysis, the influencing factors of ISR incidence included hyperlipidemia, stent type as bare stent, internal carotid artery stenosis and bilateral vertebral artery stenosis ($P<0.05$). **Conclusion:** The clinical efficacy of SI surgical treatment for VAOS patients is good, and the influencing factors of postoperative ISR mainly include hyperlipidemia and stent type as

* 基金项目:国家自然科学基金面上项目(81271440)

作者简介:姜海波(1985-),男,本科,主治医师,研究方向:脑血管病,E-mail: jhb19850722@163.com

△ 通讯作者:王小姗(1971-),女,博士,主任医师,研究方向:神经内科疾病,E-mail: wxs_1971006@163.com

(收稿日期:2020-06-06 接受日期:2020-06-30)

bare stent, combined with internal carotid artery stenosis and bilateral vertebral artery stenosis, which should be paid attention to clinically.

Key words: Stent implantation; Vertebral artery origin stenosis; Clinical efficacy; Postoperative; In-stent restenosis; Influencing factors

Chinese Library Classification(CLC): R743 Document code: A

Article ID: 1673-6273(2020)22-4274-05

前言

临床上,对于缺血型脑卒中而言,其主要发病机制在于患者的颈动脉和椎动脉狭窄与闭塞所导致的脑供血不足等因素有关。在这之中,因脑后循环障碍所引发的情况大约为30%,而其中有较大比例的原因是由于椎动脉起始段狭窄(VAOS)而致病,对患者的预后具有不利影响[1,2]。近年来,临床上公认内置支架可较好地扩张血管,并能优化患者的脑循环,且支架置入术(SI)已被广泛地应用于脑血管扩张等术式,亦可获得较为满意的疗效[3,4]。但也有报道指出,VAOS患者在完成SI术式后仍有可能出现支架内再狭窄(ISR)等现象[5,6]。鉴于此,为更好地开展临床治疗,本文通过研究SI治疗VAOS的临床疗效,并分析术后ISR的影响因素,旨在为临床治疗方案的优化提供思路支持,现报道如下。

1 资料和方法

1.1 临床资料

选择从2018年1月到2020年2月在我院接受SI治疗的VAOS患者83例纳入本次研究。其中男57例,女26例;年龄40～82岁,平均(64.11± 6.44)岁。纳入标准:(1)患者均通过脑血管造影术诊断为VAOS,且狭窄率超过70%[7];(2)有SI术式指征;(3)患者或其家属已对此次研究做到知情同意,并已签署同意书。排除标准:(1)非初次就诊的脑卒中患者;(2)既往已实施过支架治疗者;(3) 因动脉炎或动脉夹层产生的有关椎动脉狭窄;(4)存在心源性栓塞者;(5)预估患者的生存期<1年者;(6)资料数据缺失者。随访后根据患者是否发生ISR(狭窄率>20%记为再狭窄),将其分成ISR组(n=28)和无ISR组(n=53)。此次研究已得到医院的伦理委员会审批。

1.2 研究方法

整理并记录所有患者的以下数据信息:(1)年龄;(2)性别;(3)高血压情况;(4)糖尿病情况;(5)高脂血症;(6)高尿酸血症;(7)冠心病;(8)吸烟情况;(9)饮酒情况;(10)合并脑动脉的狭窄情况;(11)合并颈内动脉的狭窄情况;(12)应用质子泵抑制剂情况;(13) 应用他汀类药物情况;(14) 应用胰岛素情况;(15)椎动脉的狭窄部位;(16)支架类型;(17)支架长度;(18)支架直径;(19)狭窄率;(20)狭窄血管长度;(21)收缩期峰值流速(PSV);(22)舒张期末流速(EDV);(23)美国国立卫生院卒中量表(NIHSS)评分。

1.3 统计学方法

采用SPSS21.0统计软件分析, 涉及的计数资料均由(n,%)表示,其比较实施 x^2 检验。而对计量资料用($\bar{x}\pm s$)表示,其比较给予t检验。相关性采用Pearson法进行评价,影响因素的分析实施Logistic回归性分析。P<0.05为差异有统计学意义。

2 结果

2.1 患者的临床疗效分析

83例VAOS患者接受SI术式治疗后,82例手术成功,成功率为98.80%,1例由于发生椎动脉夹层而导致手术失败。术后有3例患者发生动脉痉挛,给予尼莫同后逐渐缓解;另有1例患者在术后7d由于继发脑出血而死亡, 并发症的总发生率为4.82%(4/83)。此外,在剔除1例手术失败及1例死亡患者的病例后,对剩余81例患者均随访1～20个月,平均随访中位数为10个月。共发生ISR 28例,发生率是34.57%,而未发生ISR 53例,占比为65.43%。

2.2 患者发生ISR的单因素情况分析

ISR组的高脂血症、合并颈内动脉的狭窄、椎动脉的狭窄部位为双侧、支架类型为裸支架的比例分别高于无ISR组(均P<0.05)。两组的年龄、性别、合并高血压、合并糖尿病、合并高尿酸血症、合并冠心病、吸烟、饮酒、合并脑动脉的狭窄、应用质子泵抑制剂、应用他汀类药物、应用胰岛素比例、支架长度、支架直径、狭窄率、狭窄血管长度、PSV、EDV、NIHSS评分相比,差异均不显著(P>0.05),见表1。

2.3 患者NIHSS评分与血管狭窄情况及血流动力学指标的相关性分析

根据Pearson法分析相关性显示,患者NIHSS评分与血管狭窄率、狭窄血管长度、PSV和EDV均呈正相关(P<0.05),见表2。

2.4 患者发生ISR多因素Logistic回归分析

将患者发生ISR作为因变量,将高脂血症(无=0;有=1)、支架类型(药物支架=0;裸支架=1)、合并颈内动脉的狭窄(无=0;有=1)以及并发双侧椎动脉的狭窄(无=0;有=1)作为自变量,根据Logistic回归分析显示,患者发生ISR影响因素包含高脂血症和支架类型为裸支架,以及合并颈内动脉的狭窄和并发双侧椎动脉的狭窄(OR>1,P<0.05),见表3。

3 讨论

近年来,我国脑血管类疾病的发病率持续上升,且此类疾病会对患者的身体及心理均造成较为严重的影响[8]。目前,临床医务工作者已对此类疾病进行了科学的研究分析,证实了缺血型脑血管类疾病的发生比例相对较高,且超过20%的缺血型脑卒中均属于脑部的后循环缺血,然而椎动脉狭窄往往是引起后循环缺血及梗死的一个重要因素[9-11]。有数据资料也显示,VAOS对此类疾病的发病具有较大的影响[12,13]。因此,在临床治疗时,如何科学地缓解相关血管内部的狭窄症状已成为了医务工作者们的主要努力方向。当前,SI术式虽然已被公认是治疗VAOS的关键性手术方案, 亦存在相对较高的手术成功率,能够安全而高效地对病灶区的狭窄症状实施缓解,然而部分患者在术后依旧可能会存在比较高的再狭窄概率[14-16]。因此,为了更加科学地对患者实施有效治疗, 研究SI术式治疗VAOS的临床疗效,并分析术后ISR的影响因素具有重要的实际意义。

表 1 患者发生 ISR 的单因素情况分析

Table 1 Single factor analysis of ISR incidence in patients

Items		ISR group(n=28)	No ISR group(n=53)	t/x^2	*P*
Age(years)		64.52± 3.68	65.01± 4.12	0.528	0.599
Male/female		16/12	41/12	3.591	0.058
Hypertension		24(85.71)	41(77.36)	0.807	0.369
Diabetes		3(10.71)	11(20.75)	1.292	0.256
Hyperlipidemia		13(46.43)	12(22.64)	4.858	0.028
Hyperuricemia		4(14.29)	11(20.75)	0.508	0.476
Coronary heart disease		3(10.71)	7(13.21)	0.105	0.746
Smoking		12(42.86)	26(49.06)	0.283	0.595
Drinking		8(28.57)	13(24.53)	0.156	0.693
Combined with cerebral artery stenosis		4(14.29)	9(16.98)	0.099	0.753
Combined with internal carotid artery stenosis		19(67.86)	22(41.51)	5.088	0.024
Use proton pump inhibitors		3(10.71)	5(9.43)	0.034	0.854
Use proton pump inhibitors		12(42.86)	20(37.74)	0.201	0.654
Use insulin		3(10.71)	10(18.87)	0.904	0.342
Stenosis site of vertebral artery	Unilateral	11(39.29)	43(81.13)	14.437	0.000
	Bilateral	17(60.71)	10(18.87)		
Stent type	Bare stent	20(71.43)	23(43.40)	5.781	0.016
	Drug stent	8(28.57)	30(56.60)		
Stent length(mm)	＜15	15(53.57)	31(58.49)	0.181	0.671
	≥ 15	13(46.43)	22(41.51)		
Stent iameter(mm)	＜4	15(53.57)	26(49.06)	0.149	0.699
	≥ 4	13(46.43)	27(50.94)		
Stenosis rate(%)	Preoperative	84.36± 6.18	85.02± 5.94	0.469	0.640
	Postoperative	3.82± 1.13	3.85± 1.48	0.094	0.926
Stenosis vessels length (mm)	Preoperative	5.12± 1.37	5.09± 1.44	0.091	0.928
	Postoperative	0.46± 0.10	0.48± 0.12	0.754	0.453
PSV(cm/s)	Preoperative	223.49± 36.97	224.18± 37.81	0.079	0.938
	Postoperative	97.24± 20.32	98.03± 20.66	0.165	0.870
EDV(cm/s)	Preoperative	73.67± 19.21	73.70± 20.33	0.006	0.995
	Postoperative	33.26± 5.84	33.48± 6.13	0.156	0.876
NIHSS score(score)	Preoperative	17.91± 3.06	17.94± 3.20	0.041	0.968
	Postoperative	10.47± 2.33	10.51± 2.08	0.079	0.937

表 2 患者 NIHSS 评分与血管狭窄情况及血流动力学指标的相关性分析

Table 2 Correlation analysis of NIHSS score with vascular stenosis and hemodynamic indexes

Items	NIHSS score	
	r	*P*
Stenosis rate	0.754	0.000
Stenosis vessels length	0.607	0.013
PSV	0.549	0.027
EDV	0.611	0.010

表 3 患者发生 ISR 多因素 Logistic 回归分析

Table 3 Multivariate logistic regression analysis of ISR incidence in patients

Factors	Regression coefficient	OR	Wald x^2	95% confidence interval	P
Hyperlipidemia	0.941	2.516	6.840	1.074-8.037	0.000
Stent type as bare sten	0.858	1.411	4.327	1.015-4.949	0.002
Combined with internal carotid artery stenosis	0.846	1.327	3.982	1.008-5.142	0.003
Combined with bilateral vertebral artery stenosis	0.650	1.018	3.136	1.033-10.257	0.012

本文通过总结分析后的结果显示,83 例 VAOS 患者接受 SI 术式治疗后,82 例手术成功,成功率为 98.80%,并发症的总发生率为 4.82%。上述结果充分提示了为 VAOS 患者实施 SI 术式进行治疗的成功率较高,已接近 100%,说明了 SI 术式的应用价值较高,具有较好的推广效应[17-19]。但在手术治疗过程当中,亦需关注椎动脉夹层和动脉痉挛,以及脑出血等情况,这可能对术者而言需要较长时间的学习曲线,同时也要求术者对操作技术的掌握应做到更加严谨仔细,防止对患者出现更加严重的危害[20-22]。此外,随访过程中一共发生 ISR 28 例,发生率是 34.57%。这表明了 ISR 在术后的产生概率也较高,值得在临床治疗过程中引起重视。此外,ISR 组的高脂血症、合并颈内动脉的狭窄、椎动脉的狭窄部位为双侧、支架类型为裸支架的比例分别高于无 ISR 组,表明了患者在术后发生 ISR 可能与上述因素有关,且上述因素的存在可能增加了 ISR 的发生概率。根据 Logistic 回归分析后显示,患者发生 ISR 影响因素包含高脂血症和支架类型为裸支架,以及合并颈内动脉的狭窄和并发双侧椎动脉的狭窄,这提示了上述因素的确参与了接受 SI 术式治疗的 VAOS 患者发生 ISR 的有关过程。分析原因,在高脂血症方面,发生 ISR 的机制主要可能是因为对患者实施支架置入手术时引起血管内膜的损伤,致使脂质在此受损区域发生沉积[23-25]。同时,高脂血症的患者发生的异常血脂代谢过程可能导致血液的黏稠度上升,血流下降,且血液所含血小板及单核 - 巨噬细胞相关物质亦可在血管内膜发生沉积,加速了平滑肌细胞相关因子释放,进而导致平滑肌细胞发生迁移及增殖,最终促使了 ISR 发生。在支架类型为裸支架方面,由于使用药物支架进行置入之后产生的局部炎症反应往往较轻,存在较好的抗炎效果,加之血管内皮的修复过程较为迅速,血管功能也相对完好,因此发生 ISR 的概率也相对较低[26,27]。在合并颈内动脉的狭窄和并发双侧椎动脉的狭窄的方面,这主要是由于上述动脉的狭窄区域不利于血流的正常运行,致使患者的血管状况相对较差,血流压力也随之增大,最终引起了 ISR 的发生。本文还根据 Pearson 法分析相关性显示,患者 NIHSS 评分与血管狭窄率和狭窄血管长度,以及 PSV 和 EDV 均呈正相关,由于 NIHSS 评分主要反映了患者的神经功能缺损状态,这些结果也表明了患者的神经功能缺损等临床症状与其血管狭窄及血流动力学等指标有较大联系。这也与临床实际及医学的普遍共识基本相符。需要指出的是,为避免 ISR 的产生,临床可通过积极地治疗患者的高脂血症,选用药物支架,以及尽可能地减少相关动脉狭窄的临床症状,从而更好地帮助患者获得相对更佳的预后[28-30]。

综上所述,SI 术式治疗的 VAOS 患者的临床疗效较好,且术后 ISR 的影响因素主要包含高脂血症和支架类型为裸支架,以及合并颈内动脉的狭窄和并发双侧椎动脉的狭窄,临床上应引起相应的重视。

参 考 文 献(References)

[1] 马妍, 宋刚, 王旭, 等. 椎动脉起始段狭窄支架置入术后再狭窄危险因素的分析[J].中国脑血管病杂志, 2015, 12(7): 337-341

[2] Kohta M, Fujita A, Yamashita S, et al. Ultrasonographically-guided stent placement at the vertebral artery origin without contrast medium: A case report[J]. J Clin Ultrasound, 2020, 48(6): 362-366

[3] Katsarou M, Bertoglio L. Atypical Carotid Origin of the Verte bral Artery[J]. Eur J Vasc Endovasc Surg, 2019, 57(3): 423-424

[4] Schneider V, Dirschinger R, Wustrow I, et al. Endovascular therapy of subclavian artery occlusive disease involving the vertebral artery origin[J]. Vasa, 2020, 49(3): 205-213

[5] Broussalis E, Kunz AB, Luthringshausen G, et al. Treatment of vertebral artery origin stenosis with a Pharos stent device: a single center experience[J]. Interv Neuroradiol, 2011, 17(3): 316-322

[6] 林永娟, 冯契, 俞婷婷, 等. 椎动脉狭窄血管成形术后支架内再狭窄危险因素相关性研究[J].东南国防医药, 2017, 19(2): 136-140

[7] 冯明陶, 戴琳孙, 唐海双, 等. 不同类型支架治疗椎动脉中重度狭窄的疗效分析[J].中国脑血管病杂志, 2018, 15(8): 393-397

[8] 邢效如, 郝雅男, 孙志, 等. 血管内支架介入成形术对老年缺血性脑血管病患者的神经功能、动脉血流速度及预后的影响[J]. 现代生物医学进展, 2020, 20(12): 2289-2292, 2328

[9] 李景植, 华扬, 刘然, 等. 椎动脉支架置入术后再狭窄的发生率及血流动力学评价 [J]. 中华医学超声杂志（电子版）, 2019, 16(10): 756-761

[10] Katsuki M, Yamamoto Y, Wada N, et al. Occipital artery to extracranial vertebral artery anastomosis for bilateral vertebral artery stenosis at the origin: A case report[J]. Surg Neurol Int, 2018, 16(9): 82-83

[11] Markus HS, Larsson SC, Kuker W, et al. Stenting for symptomatic vertebral artery stenosis: the vertebral artery inschemia stenting trial [J]. Neurology, 2017, 89(12): 1229-1236

[12] 闫宏伟, 徐善才, 张广, 等. 椎动脉起始部支架置入后再狭窄因素的研究进展[J].中国脑血管病杂志, 2018, 15(7): 378-381

[13] Sharma A, Ojha V, Raju SN, et al. Anomalous vertebral artery origin from common carotid artery[J]. Asian Cardiovasc Thorac Ann, 2020, 28(3): 185-186

[14] Buchanan KD, Torguson R, Rogers T, et al. In-stent restenosis of drug-eluting stents compared with a matched group of patients with

de novo coronary artery stenosis [J]. Am J Cardiol, 2018, 71(11): 1033-1034

[15] 邓伟胜, 凌维汉, 王弘, 等. 症状性椎动脉狭窄支架植入术后再狭窄的相关危险因素分析[J].临床荟萃, 2020, 35(6): 521-524

[16] Hendricks BK, Spetzler RF. Vertebral Artery to Common Carotid Artery Transposition: 2-Dimensional Operative Video [J]. Oper Neurosurg (Hagerstown), 2019, 17(5): 198-199

[17] Ota T, Fujitani S, Fujimoto S, et al. A Rare Anomalous Origin of the Right Vertebral Artery from the Internal Carotid Artery with an Aberrant Right Subclavian Artery [J]. World Neurosurg, 2020, 7(139): 250-252

[18] Wang Y, Ma Y, Gao P, et al. First Report of Drug-Coated Balloon Angioplasty for Vertebral Artery Origin Stenosis [J]. JACC Cardiovasc Interv, 2018, 11(5): 500-502

[19] Lu T, Liang J, Wei N, et al. Extracranial Artery Stenosis Is Associated With Total MRI Burden of Cerebral Small Vessel Disease in Ischemic Stroke Patients of Suspected Small or Large Artery Origins [J]. Front Neurol, 2019, 21(10): 243-244

[20] 李霞, 杜汉军, 乔淑冬, 等. 椎动脉起始段支架置入术后再狭窄的危险因素分析[J].中华老年心脑血管病杂志, 2019, 21(3): 282-285

[21] Che WQ, Dong H, Jiang XJ, et al. Clinical outcomes and influencing factors of in-stent restenosis after stenting for symptomatic stenosis of the vertebral V1 segment[J]. J Vasc Surg, 2018, 68(5): 1406-1413

[22] Qureshi AI, Wang Y, Afzal MR, et al. Vertebral Artery Origin Stent Placement Using the Dual Lumen Qureshi-Jiao Guidecatheter [J]. J Vasc Interv Neurol, 2017, 9(6): 38-42

[23] Wolska-Krawczyk M, Drunck M, Behnke S, et al. Risk Factors for Restenosis After Stenting or Angioplasty of Vertebral Artery Origin : Results of Short-term and Long-term Follow-up[J]. Clin Neuroradiol, 2020, 30(2): 355-362

[24] Li J, Hua Y, Needleman, et al. Arterial occlusions increase the risk of in-stent restenosis after vertebral artery ostium stenting[J]. J Neurointerv Surg, 2018, 10(10): 1016-1019

[25] Shao JX, Ling YA, Du HP, et al. Comparison of hemodynamic changes and prognosis between stenting and standardized medi cal treatment in patients with symptomatic moderate to severe vertebral artery origin stenosis [J]. Medicine (Baltimore), 2019, 98(13): 14899-14900

[26] Chen W, Huang F, Li M, et al. Incidence and predictors of the in-stent restenosis after vertebral artery ostium stenting [J]. J Stroke Cerebrovasc Dis, 2018, 27(11): 3030-3035

[27] Geng X, Hussain M, Du H, et al. Comparison of self-expanding stents with distal embolic protection to balloon-expandable stents without a protection device in the treatment of symptomatic vertebral artery origin stenosis: a prospective randomized trial [J]. J Endovasc Ther, 2015, 22(3): 436-444

[28] Zheng D, Mingyue Z, Wei S, et al. The incidence and risk factors of in-stent restenosis for vertebrobasilar artery stenting[J]. World Neurosurgy, 2018, 4(110): 937-941

[29] Dinoto E, Pecoraro F, Mirabella D, et al. Endovascular Treatment with Drug-Eluting Balloon for Severe Subclavian Artery Stenosis Involving the Origin of the Vertebral Artery [J]. Transl Med UniSa, 2020, 20(21): 35-37

[30] Rangel-Castilla L, Gandhi S, Munich SA, et al. Experience with vertebral artery origin stenting and ostium dilatation: results of treatment and clinical outcomes[J]. J Neurointerv Surg, 2016, 8(5): 476-480

(上接第 4347 页)

[27] Saydam M, Sahin M, Yilmaz KB, et al. Correlation of pelvic fractures and associated injuries: An analysis of 471 pelvic trauma patients[J]. Ulus Travma Acil Cerrahi Derg, 2019, 25(5): 489-496

[28] Taha T, Mahmoud K, Attia A K, et al. Delayed Soft Tissue Necrosis in an Atypical Closed Calcaneal Fracture: A Case Report[J]. J Orthop Case Rep, 2019, 9(2): 11-14

[29] Tomori Y, Nanno M, Takai S. Closed rupture of extensor tendon resulting from untreated Kienbock disease: A case report and a review of the literature[J]. Medicine (Baltimore), 2019, 98(33): e16900

[30] Toor H, Bowen I, Zampella B, et al. Efficacy of Trauma Catheter and Mushroom Tip Catheter in Evacuation of Chronic Subdural Hematoma and Complications of Drain Placement [J]. Cureus, 2019, 11(7): e5123

[31] Wang H, Wang C, Ruan J, et al. Asymmetrical bilateral sternoclavicular joint dislocation combined with bilateral clavicular fracture: A case report[J]. Medicine (Baltimore), 2019, 98(28): e16359