

doi: 10.13241/j.cnki.pmb.2020.14.025

经皮 RTS 钉固定与常规椎弓根固定在胸腰段压缩骨折中的疗效比较 *

杨智泉^{1,2} 高 东¹ 李耀章¹ 张 伟¹ 李卫勤¹ 白马恒^{1Δ}

(1 陕西省榆林市星元(第四)医院骨二科 陕西 榆林 719000; 2 空军军医大学附属唐都医院骨科 陕西 西安 710038)

摘要 目的:分析和比较使用经皮 RTS 钉固定与常规椎弓根固定在胸腰段骨折中的临床疗效和安全性。**方法:**对 2017 年 6 月至 2018 年 6 月在我院住院,经诊断为胸腰段骨折,且经纳入及排除标准筛选后的共计 74 例患者进行回顾性分析。根据不同的手术方式和选择,将纳入的患者分为经皮 RTS 钉固定组(观察组;40 例)和常规椎弓根螺钉固定组(对照组;34 例)。在术后的 3 天,1 月及 1 年比较两组患者的疼痛评分及功能评分;并通过其影像学指标(伤椎高度恢复, Cobb 角恢复等)比较两组的影像学疗效;比较两组患者的手术时间,出血量,切口长度等手术指标;比较两组患者的并发症等情况。**结果:**在术后 3 天时,观察组患者的 VAS 评分显著优于对照组($P<0.05$),而在术后 1 月及 1 年时,两组患者未见显著差异($P>0.05$)。两组患者的 Cobb 角及前缘高度百分比较术前均有显著改善($P<0.05$),且两组间均有显著差异($P<0.05$)。两组患者在手术时间,切口长度,透视次数,出血量,出院时间等均有显著差异($P<0.05$)。两组患者在并发症的比较中并无统计学差异($P>0.05$)。**结论:**与常规的开放椎弓根螺钉固定相比,对于胸腰椎压缩骨折,RTS 螺钉能够有效的恢复影像学指标,特别是在前缘高度及 Cobb 角恢复,并且能够有效地减少创伤及出血,加快功能恢复,在临床中可以进一步推广。

关键词:胸腰椎骨折;RTS;椎弓根螺钉**中图分类号:**R683 **文献标识码:**A **文章编号:**1673-6273(2020)14-2715-04

Comparison of the Clinical Effect of RTS Percutaneous Pedicle Screw Placement and Conventional Pedicle Screws in the Treatment of Thoracolumbar Fractures*

YANG Zhi-quan^{1,2}, GAO Dong¹, LI Yao-zhang¹, ZHANG Wei¹, LI Wei-qin¹, BAI Ma-heng^{1Δ}

(1 Department of orthopedic, Xingyuan Hospital, Yulin, Shaanxi, 719000, China;

2 Department of orthopedics, Tangdu Hospital, Air Force Medical University, Xi'an, Shaanxi, 710038, China)

ABSTRACT Objective: To compare the clinical effect of RTS percutaneous pedicle screw placement and conventional pedicle screws in the Treatment of Thoracolumbar Fractures. **Methods:** From 2017.06 to 2018.06, 74 cases of Thoracolumbar Fractures were divided into two groups according to different operation ways. 40 patients underwent surgery using RTS percutaneous pedicle screw placement (experimental group), while 30 patients underwent surgery with the conventional pedicle screws (control group). The VAS and ODI scores in 3 days, 1 month, 6 months and 12 months after operations, percentage of anterior height of injured vertebrae and Cobb angle before and 1 month, 12 months after operations, blood loss, operation time, hospital stay were analyzed. **Results:** 3 days after operation, the VAS score of the experimental group was lower than that of control group ($P<0.05$), while there was no significant difference in 6 months and 12 months after operation ($P>0.05$). Percentage of anterior height and Cobb angle improved significantly immediately after operation ($P<0.05$) and there was significant differences between 2 groups ($P<0.05$). There were significant differences in blood loss, operation time and hospital stay between the two groups ($P<0.05$). There was no significant difference in the complications between the two groups. **Conclusions:** Comparing the conventional method, using the RTS percutaneous pedicle screw placement can effective recovery of imaging, especially the anterior edge height of vertebral body and the Cobb angle, effectively reduce the trauma and hemorrhage, speed up the functional recovery, which can further promote in the clinical.

Key words: Thoracolumbar fractures; RTS pedicle screw; Pedicle screws**Chinese Library Classification(CLC):** R683 **Document code:** A**Article ID:** 1673-6273(2020)14-2715-04

前言

胸腰椎骨折一直是脊柱创伤中的常见病和多发病,有报道显示其发病率可高达 70%^[1]。随着工作方式的改变及老龄化社

* 基金项目:国家自然科学基金项目(81702935)

作者简介:杨智泉(1980-),本科,副主任医师,主要从事创伤、脊柱外科技术的诊治,电话:13689224943, E-mail: gan_7758525@163.com

Δ 通讯作者:白马恒(1976-),本科,主要从事脊柱外科技术的诊治,电话:15621850979, E-mail: gan_7758525@163.com

(收稿日期:2020-01-23 接受日期:2020-02-18)

会的到来,其发病率更是逐年上升。绝大多数的骨折的发病原因是由于钝性的损伤导致的,这其中又主要分为发生在年轻患者中的高能量损伤以及发生在老年骨质疏松患者中的脆性损伤^[2]。胸腰椎骨折之所以成为整个脊柱中的最高发位置,是因为在胸腰段所连接的胸椎和腰椎的活动度截然不同,从而导致此位置容易产生更大的应力集中,一旦出现受力,便容易产生骨折^[3]。胸腰椎骨折后会出现诸多并发症,如后凸畸形,慢性腰背部疼痛,甚至会出现神经功能障碍,截瘫等^[4]。胸腰椎骨折根据不同的骨折情况,可大体分为压缩、张力带及位移三种类型^[5]。压缩骨折是胸腰椎骨折中最为常见,也是临床治疗中最为经典的骨折类型。在经典的治疗办法中,多采用开放椎弓根螺钉固定的手术方法,此方法能够取得良好的复位和固定效果,已被广泛的应用于临床^[6]。但此种方法有着诸多问题,例如创伤出血较多,创伤较大,恢复较慢等^[7]。在最近几年,随着微创化理念的使用,各种经皮螺钉被使用于临床,但多为万向螺钉或单平面钉,更由于经皮微创的限制,骨折的复位效果难以达到和维持^[8]。我们使用了一种新的微创撑开螺钉-RTS经皮螺钉。此种器械能够通过独特的设计转化为撑开力,从而有效的恢复椎体高度,并能够保持良好的微创治疗效果和安全性。现汇报如下。

1 资料和方法

1.1 研究对象

为本次实验的进行,我们首先结合相关文献,制定了相应的纳入及排除标准^[9]。

本次研究的纳入和排除标准如下:纳入标准^[10]:①患者明确诊断为椎体骨折,且为单节段,责任节段在胸10椎体-腰2椎体之间;②患者年龄在18-60岁之间;③患者为新鲜骨折,且AO Magerl分型为A型。排除标准^[10]:①患者有严重的骨质疏松或患者的骨折为脆性骨折;②患者合并有神经损伤症状;③患者合并肿瘤及其他全身系统性疾病。

按照上述纳入及排除标准,将2017.06至2018.06时间内行手术治疗的A型单节段胸腰椎骨折患者进行筛选,共有74名患者被纳入本次实验中。根据手术方法及采用器械的区别,将其分为经皮RTS钉固定组(观察组;40例)和常规椎弓根螺钉固定组(对照组;34例)。其中,在性别因素中,观察组的男性:女性为22名:18名,对照组的男性:女性为20名:14名;在年龄因素中,观察组:对照组为42.8±8.9岁:40.9±9.3岁;在骨折分型中,观察组为A1:A2:A3为15:12:13,对照组则为

A1:A2:A3为12:10:12。观察组的骨折节段分布为T10:T11:T12:L1:L2为2:4:13:15:6;对照组的分布则为T10:T11:T12:L1:L2为1:3:12:13:5。两组患者年龄,性别,AO分型及骨折节段分布等一般性资料经统计学分析后未发现显著统计学差异($P>0.05$),具有可比性。

1.2 方法

1.2.1 手术方法 在本次研究中的患者均使用全身麻醉的方法,其手术主刀医生为同一人。观察组:患者麻醉满意后,首先使用C型臂进行体表定位,确定上下椎体椎弓根的位置。常规消毒铺单后,根据体表定位,选择合适的切口,然后在导丝的辅助下,逐级使用扩张器,在肌肉间隙内直达患椎的关节突及置钉位置。使用开口器、攻丝等对椎弓根进行处理,拧入RTS螺钉,进行加压撑开。C型臂再次透视满意后,安置双侧棒。冲洗,留置引流后,逐层缝合切口。

对照组:采用常规后正中入路。逐层切开并使用电刀充分暴露椎板和关节突。使用开口、开路器确定钉道,置入椎弓根螺钉,使用撑开器进行适度撑开,C型臂再次透视满意后,安置双侧棒。冲洗,留置引流后,逐层缝合切口。

1.2.2 术后护理 按照抗生素指南对患者使用抗生素。患者术后当天即进行卧床功能锻炼。术后48-72h拔除引流管。术后12天左右视切口情况给予拔除引流管。

1.2.3 评价方法 患者的疼痛指标采用国际通用的VAS^[11]评分进行评价。最高分为10分,指极限疼痛。最低为0分,即完全不痛。影像学评价则主要通过患者前缘高度百分比及Cobb角进行评价^[12]。椎体前缘高度百分比是指前缘高度/后缘高度%。Cobb角是指相邻椎体上下终板的划线成角。

1.3 统计学分析

使用SPSS 19.0根据不同的样本类型采用不同的检验方法,计数资料采用卡方检验,计量资料采用t检验,以 $P<0.05$ 为差异有统计学意义。

2 结果

2.1 观察组与对照组在VAS疼痛中的比较情况

研究结果显示,两组患者在术前并无显著性差异($P>0.05$),在术后的疼痛评分均显著好于术前。观察组患者在术后3天时的VAS显著优于对照组($P<0.05$),但在术后1月及1年时,两组患者间并无统计学差异($P>0.05$)。见表1。

表1 2组患者疼痛指标的比较($\bar{x} \pm s$)
Table 1 The VAS scores between 2 groups ($\bar{x} \pm s$)

Groups	Before operation	3 days after operation	1 months after operation	6 months after operation	12 months after operation
Observe group	7.23± 0.88	4.25± 0.84	1.43± 0.23	1.05± 0.13	1.23± 0.12
Control group	7.18± 0.91	5.12± 0.75	1.34± 0.35	0.96± 0.21	1.21± 0.22
P	>0.05	<0.05	>0.05	>0.05	>0.05

2.2 两组患者在Cobb角中的比较

研究结果显示,两组患者在术前的Cobb角度并无显著性差异($P>0.05$),在术后的Cobb角均显著好于术前。且观察组患

者在术后3天及术后1年时的Cobb均显著优于对照组($P<0.05$)。见表2。

表 2 两组患者的 Cobb 评分比较情况($\bar{x} \pm s$)
Table 2 The Cobb scores between 2 groups ($\bar{x} \pm s$)

Groups	Before operation	3 days after operation	12 months after operation
Observe group	18.54 $\pm$ 3.27	12.56 $\pm$ 2.23	14.25 $\pm$ 4.27
Control group	18.36 $\pm$ 3.48	7.84 $\pm$ 1.26	9.14 $\pm$ 1.78
<i>P</i>	>0.05	<0.05	<0.05

2.3 两组患者在责任椎体前缘高度百分比中的比较

研究结果显示,两组患者在术前的椎体前缘高度百分比并无显著性差异($P>0.05$),在术后的椎体前缘高度百分比均显著

好于术前。且观察组患者在术后 3 天及术后 1 年时的椎体前缘高度百分比均显著优于对照组 ($P<0.05$)。见表 3。

表 3 2 组患者椎体前缘高度百分比的比较(%)
Table 3 Comparison of anterior vertebral body height of patients in both groups (%)

Groups	Before operation	3 days after operation	12 months after operation
Observe group	73.48 $\pm$ 6.71	83.24 $\pm$ 8.33	79.25 $\pm$ 6.27
Control group	72.86 $\pm$ 7.35	92.18 $\pm$ 6.22	87.14 $\pm$ 4.79
<i>P</i>	>0.05	<0.05	<0.05

3 讨论

脊柱椎体骨折现在已经成为创伤骨折中发病率较高的一种类型^[13]。尤其是由于解剖结构和生物力学的原因,胸腰椎段骨折更是其中最为主要的类型^[14]。尽管保守治疗能够取得一定的治疗效果,但相当一部分患者会出现畸形、慢性疼痛等诸多并发症。更为重要的是,保守治疗要求长时间卧床,会导致褥疮、坠积性肺炎等诸多并发症^[15]。因此,对于绝大多数患者来讲,采用恢复快,功能改善良好的手术治疗已经成为第一选择^[16]。

相关研究显示^[17],由于胸椎有肋骨进行固定支持,而腰椎单纯受力,因此椎体受力的峰值均几乎出现在胸腰段,且几乎所有的姿势或活动都会将最大受力负荷于胸腰段。因此,此处为全身椎体骨折的最好发位置^[18]。从另一个角度出发,一旦此处发生骨折及椎体压缩,其高度的恢复和复位也相对最难^[19]。特别是对于 A 型压缩骨折来讲,由于复位困难的原因,单纯的保守治疗很难达到满意的恢复高度的目的,且容易产生畸形及邻近节段的骨折^[20]。同时,由于椎旁肌被长期异常刺激,腰背部的慢性疼痛也极易出现^[21]。因此,对于诊断明确的胸腰段的 A 型压缩骨折,尽快的进行手术治疗,已经得到大家的共识^[22]。

在很长一段时间内,开放切口、充分显露解剖结构、置钉撑开固定是针对此类疾病的最常见的治疗和手术方法。尽管能够取得不错的手术效果,特别是直接撑开和复位的效果能够得到保障,但创伤较大、出血较多且恢复很慢^[23]。最为重要的是,由于会对周围肌肉、关节稳定性、关节突造成损伤,因此容易引发慢性腰背部疼痛等诸多问题^[24]。随着微创理念的逐渐深入和微创器械的不断发展,微创治疗也逐渐应用于胸腰段骨折的治疗中^[25]。各种经皮微创螺钉被使用于此类疾病,并收到了良好的临床效果。但绝大多数微创经皮螺钉均为万向螺钉,尽管几乎均配备相关的经皮撑开辅助器械,但其基本的撑开原理都是利用螺钉钉尾的直接撑开来实现复位的目的^[26]。经皮力量传导到椎体后已经明显减少,且绝大部分力量只能集中在椎体的后

缘,因此对于前缘的压缩高度的恢复很难起到很好的效果^[27]。

RTS 经皮撑开螺钉是一种设计理念完全不同的针对骨折复位的椎弓根螺钉。其主要特色和区别是它具有一个斜角的设计^[28]。与常规直接撑开不同,当 RTS 钉棒置钉完毕后,可通过对螺钉的加压,使得压力经斜角弧槽转化为撑开力,即将垂直于躯体的压力转化为纵行的复位力量,从而起到良好的撑开效果。其最后的撑开角度为连接棒与螺钉弧槽之间的锐角角度。据相关显示^[29,30],其撑开力可高达 15Kg。与常规的椎弓根螺钉相比,RTS 螺钉有如下的优势和特色:1)复位的确定性。相对于传统螺钉的诸多限制和不确定性。RTS 螺钉的撑开力量和撑开角度可以进行预估,从而在术前就可以对手术的情况进行预计和模拟,已达到最佳的撑开效果。2)创伤的控制。此方法按照微创的理念设计和进行。从肌肉间隙入路,不破坏后方重要的结构,不去强行剥离椎旁肌肉,从而有效的控制了出血、组织损伤和瘢痕水肿的形成。3)对椎体前缘复位的有效性。与传统的后方直接撑开不同,此方法是利用螺钉与钉棒的角度改变进行撑开,因此能对前方,特别是椎体前缘起到良好的治疗作用。并且由于是将力量直接作用于椎体的内部,因此可以尽量减少后纵韧带、椎间盘等造成的牵引力的干扰。

本次实验结果再次显示了 RTS 螺钉的巨大优势。尽管中远期两组患者在 VAS 疼痛指标中未见显著差异,但由于微创的独特优势(创伤小、水肿轻等),观察组在术后 3 天的疼痛感觉显著优于对照组。而通过相关的影像学评估,特别是前缘高度和 Cobb 角的变化测量,我们再次证实了 RTS 螺钉对于复位撑开的良好效果。而在围手术期各项指标的比较中,我们同样发现 RTS 螺钉具有全面的优势。其中,观察组切口长度数值高于对照组,是由于 RTS 采用的是微创经皮旁开切口,相较于对照组的中央切口,观察组双侧置钉,总长度必然较长,但每一个切口显著小于观察组。而在最为关注的并发症的比较中,两组患者并无统计学差异。对于观察组中患者皮肤发生浅层感染的原因,我们分析是由于术中透视过多,C 型臂正侧位更换过

程中触及术区所致。

当然,本次研究也有很多的遗憾和不足。例如,在本次实验中,考虑到骨质撑开的问题,我们未将骨质疏松者纳入本次研究对象中来。此外,本次研究的样本数量仍然不大,也没有进行多中心的随机和双盲设计。但无论如何,本次实验显示,RTS螺钉能够显著的恢复单节段胸腰段椎体的高度,进行有效的撑开,矫正脊柱畸形,并能够保持出血少、创伤小等微创手术的优势。在临床中可以进一步的推广。

参考文献(References)

- [1] Cankaya D, Balci M, Deveci A, et al. Better life quality and sexual function in men and their female partners with short-segment posterior fixation in the treatment of thoracolumbar junction burst fractures [J]. *Eur Spine J*, 2016, 25(4): 1128- 1134
- [2] Zhong H, Chen J, Zhang C, et al. Clinical application of vertebral arch-transverse pathway in pedicle screw implantation [J]. *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi*, 2019, 33(12): 1486- 1490
- [3] Fomekong E, Pierrard J, Raftopoulos C. Comparative Cohort Study of Percutaneous Pedicle Screw Implantation without Versus with Navigation in Patients Undergoing Surgery for Degenerative Lumbar Disc Disease[J]. *World Neurosurg*, 2018, 111e410- e417
- [4] Yu Y, Wang J, Shao G, et al. Comparing Single Versus Double Screw-Rod Anterior Instrumentation for Treating Thoracolumbar Burst Fractures with Incomplete Neurological Deficit: A Prospective, Randomized Controlled Trial [J]. *Med Sci Monit*, 2016, 22:1687-221693
- [5] Mohamadi A, Googanian A, Ahmadi A, et al. Comparison of surgical or nonsurgical treatment outcomes in patients with thoracolumbar fracture with Score 4 of TLICS: A randomized, single-blind, and single-central clinical trial[J]. *Medicine (Baltimore)*, 2018, 97(6): e9842
- [6] Lyu J, Chen K, Tang Z, et al. A comparison of three different surgical procedures in the treatment of type A thoracolumbar fractures: a randomized controlled trial[J]. *Int Orthop*, 2016, 40(6): 1233-1238
- [7] Gumussuyu G, Islam NC, Kose O, et al. Comparison of Two Segment Combined Instrumentation and Fusion versus Three Segment Posterior Instrumentation in Thoracolumbar Burst Fractures: A Randomized Clinical Trial with 10 Years of Follow Up [J]. *Turk Neurosurg*, 2019, 29(4): 555-563
- [8] Chen ZD, Wu J, Yao XT, et al. Comparison of Wiltse's paraspinal approach and open book laminectomy for thoracolumbar burst fractures with greenstick lamina fractures: a randomized controlled trial [J]. *J Orthop Surg Res*, 2018, 13(1): 43
- [9] Spiegel UJ, Jarvers JS, Heyde CE, et al. Delayed indications for additive ventral treatment of thoracolumbar burst fractures: What correction loss is to be expected[J]. *Unfallchirurg*, 2016, 119(8): 664-672
- [10] Horii C, Asai Y, Iidaka T, et al. Differences in prevalence and associated factors between mild and severe vertebral fractures in Japanese men and women: the third survey of the ROAD study[J]. *J Bone Miner Metab*, 2019, 37(5): 844-853
- [11] Wang X, Yang R, Sun H, et al. Different Effects of Intravenous, Topical, and Combined Application of Tranexamic Acid on Patients with Thoracolumbar Fracture [J]. *World Neurosurg*, 2019, 127:e1185-e1189
- [12] Iwata A, Kanayama M, Oha F, et al. Does spinopelvic alignment affect the union status in thoracolumbar osteoporotic vertebral compression fracture?[J]. *Eur J Orthop Surg Traumatol*, 2017, 27(1): 87-92
- [13] Liu L, Zhang S, Liu G, et al. Early Clinical Outcome of Lumbar Spinal Fixation With Cortical Bone Trajectory Pedicle Screws in Patients With Osteoporosis With Degenerative Disease[J]. *Orthopedics*, 2019, 42(5): e465-e471
- [14] Li K, Li Z, Ren X, et al. Effect of the percutaneous pedicle screw fixation at the fractured vertebra on the treatment of thoracolumbar fractures[J]. *Int Orthop*, 2016, 40(6): 1103-1110
- [15] Masoudi MS, Haghnegahdar A, Ghaffarpasand F, et al. Functional Recovery Following Early Kyphoplasty Versus Conservative Management in Stable Thoracolumbar Fractures in Parachute Jumpers: A Randomized Clinical Trial[J]. *Clin Spine Surg*, 2017, 30(8): E1066-E1073
- [16] Watson SL, Weeks BK, Weis LJ, et al. High-intensity exercise did not cause vertebral fractures and improves thoracic kyphosis in postmenopausal women with low to very low bone mass: the LIFTMOR trial[J]. *Osteoporos Int*, 2019, 30(5): 957-964
- [17] Smits AJ, Deunk J, Stadhouders A, et al. Is postoperative bracing after pedicle screw fixation of spine fractures necessary? Study protocol of the ORNOT study: a randomised controlled multicentre trial[J]. *BMJ Open*, 2018, 8(1): e019596
- [18] Qian Y, Lin Z, Jin C, et al. A Less-Invasive Retroperitoneal Lumbar Approach: Animal Feasibility Study and Primary Clinical Study[J]. *Clin Spine Surg*, 2017, 30(6): 251-258
- [19] Pishnamaz M, Schemmann U, Herren C, et al. Limitations in clinical outcome after posterior stabilization of thoracolumbar fractures do not correlate with dynamic trunk muscle dysfunction: an ultrasound controlled prospective cohort study[J]. *Eur J Med Res*, 2018, 23(1): 26
- [20] Lin L, Zhu M, Peng P, et al. Patient-specific drill template for C2 transoral pedicle insertion in complete reduction of atlantoaxial dislocation: cadaveric efficacy and accuracy assessments[J]. *J Orthop Surg Res*, 2019, 14(1): 141
- [21] Cheng Y, Liu Y. Percutaneous curved vertebroplasty in the treatment of thoracolumbar osteoporotic vertebral compression fractures [J]. *J Int Med Res*, 2019, 47(6): 2424-2433
- [22] Wang X, Tan L, Lin X, et al. Photoelectric guided navigation unilateral puncture of the percutaneous kyphoplasty in treatment of thoracolumbar osteoporotic vertebral compression fracture [J]. *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi*, 2018, 32(2): 203-209
- [23] Chang W, Zhang D, Liu W, et al. Posterior paraspinal muscle versus post-middle approach for the treatment of thoracolumbar burst fractures: A randomized controlled trial[J]. *Medicine (Baltimore)*, 2018, 97(25): e11193
- [24] Scholz M, Kandziora F, Tschauder T, et al. Prospective randomized controlled comparison of posterior vs. posterior-anterior stabilization of thoracolumbar incomplete cranial burst fractures in neurological intact patients: the RASPUTHINE pilot study [J]. *Eur Spine J*, 2018, 27(12): 3016-3024
- [25] Hu H, Lin X, Tan L, et al. Surgical treatment strategy for the "shell" phenomenon after thoracolumbar fracture [J]. *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi*, 2019, 33(1): 49-55 (下转第 2749 页)

- Metabolism the Official Journal of the Italian Society of Osteoporosis Mineral Metabolism & Skeletal Diseases, 2017, 14(2): 245
- [15] Ragesh Babu Thandassery, Nikhil Choudhary, Ajay Bahl, et al. Characterization of Cardiac Dysfunction by Echocardiography in Early Severe Acute Pancreatitis[J]. *Pancreas*, 2017, 46(5): 626
- [16] Peter Ivák, Jan Piňha, Ivana Králová Lesná, et al. Effect of pulsatility on markers of vascular damage in patients with implanted continuous flow mechanical circulatory support [J]. *Vnitřní Lekarství*, 2018, 64(1): 66-71
- [17] Kitamura, Katsuya, Horibe, et al. The Prognosis of Severe Acute Pancreatitis Varies According to the Segment Presenting With Low Enhanced Pancreatic Parenchyma on Early Contrast-Enhanced Computed Tomography: A Multicenter Cohort Study [J]. *Pancreas*, 2017, 46(7): 867-873
- [18] Putzu A, Fang M X, Boscolo B M, et al. Blood purification with continuous venovenous hemofiltration in patients with sepsis or acute respiratory distress syndrome. A systematic review and meta-analysis of randomized evidence [J]. *Minerva Anestesiologica*, 2017, 83(8): 867-877
- [19] Sushil Kumar Mishra, Pawan Kumar Jain, Sukhdev Gupta. Mediastinal Pseudocyst in Acute on Chronic Pancreatitis[J]. *Journal of the Association of Physicians of India*, 2016, 64(3): 80-81
- [20] Julia Veit, Richard Hakim, Monika P Jodi, et al. Cortical gamma band synchronization through somatostatin interneurons [J]. *Nature Neuroscience*, 2017, 20(7): 951-959
- [21] Sliwinska-Mosson M, Marek G, Grzebieniak Z, et al. Relationship between somatostatin and interleukin-6: A cross-sectional study in patients with acute pancreatitis[J]. *Pancreatology*, 2018, 18(8): 885-891
- [22] Ewa Łubowska-Pająk, Krzysztof Kołomecki. Assessment of Pharmacological Prophylaxis for Acute Pancreatitis Following ERCP in Patients with Cholelithiasis[J]. *Polski Przegląd Chirurgiczny*, 2016, 87(12): 620-625
- [23] Suhas Vidyadhar Abhyankar, Arvind Madhusudan Vartak. Impact of Ulinastatin on Outcomes in Acute Burns Patients [J]. *Journal of Burn Care & Research Official Publication of the American Burn Association*, 2017, 39(1): 1
- [24] Ji M, Chen T, Wang B, et al. Effects of ulinastatin combined with mechanical ventilation on oxygen metabolism, inflammation and stress response and antioxidant capacity of ARDS [J]. *Exp Ther Med*, 2018, 15(6): 4665-4670
- [25] Wang Y, Li L. Predictive values of C-reactive protein for the therapeutic effects of ulinastatin combined with somatostatin in severe acute pancreatitis and for the severity of gastrointestinal failure[J]. *Exp Ther Med*, 2018, 16(4): 3165-3171
- [26] Ji Hye Huh, Saehyun Jung, Seung Kook Cho, et al. Predictive value of apolipoprotein B and A-I ratio in severe acute pancreatitis[J]. *Journal of Gastroenterology & Hepatology*, 2018, 33(2): 548-553
- [27] Vitale DS, Hornung L, Lin TK, et al. Blood Urea Nitrogen Elevation Is a Marker for Pediatric Severe Acute Pancreatitis[J]. *Pancreas*, 2019, 48(3): 363-366

(上接第 2718 页)

- [26] Wang W, Duan K, Ma M, et al. Tranexamic Acid Decreases Visible and Hidden Blood Loss Without Affecting Prethrombotic State Molecular Markers in Transforaminal Thoracic Interbody Fusion for Treatment of Thoracolumbar Fracture-Dislocation[J]. *Spine (Phila Pa 1976)*, 2018, 43(13): E734-E739
- [27] Kitzen J, Schotanus MGM, Plasschaert HSW, et al. Treatment of thoracic or lumbar burst fractures with Balloon Assisted Endplate Reduction using Tricalcium Phosphate cement: histological and radiological evaluation[J]. *BMC Musculoskelet Disord*, 2017, 18(1): 411
- [28] Yin F, Sun Z, Yin Q, et al. Treatment of thoracolumbar burst fractures with short-segment pedicle instrumentation and recombinant human bone morphogenetic protein 2 and allogeneic bone grafting in injured vertebra[J]. *Zhongguo Xue Fu Chong Jian Wai Ke Za Zhi*, 2017, 31(9): 1080-1085
- [29] Urquhart JC, Alrehaili OA, Fisher CG, et al. Treatment of thoracolumbar burst fractures: extended follow-up of a randomized clinical trial comparing orthosis versus no orthosis [J]. *J Neurosurg Spine*, 2017, 27(1): 42-47
- [30] Spirig JM, Sutter R, Gotschi T, et al. Value of standard radiographs, computed tomography, and magnetic resonance imaging of the lumbar spine in detection of intraoperatively confirmed pedicle screw loosening-a prospective clinical trial[J]. *Spine J*, 2019, 19(3): 461-468