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伤椎置钉联合短节段内固定与单纯短节段固定 治疗胸腰椎爆裂性骨折的比较研究*

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摘要 目的:比较伤椎置钉联合短节段内固定与单纯短节段固定治疗胸腰椎爆裂性骨折的临床疗效、固定效果及其对患者炎症反应和脊髓损伤的影响。**方法:**选取2014年3月到2016年12月期间我院收治的胸腰椎爆裂性骨折患者94例,根据手术方法的不同将患者分为伤椎置钉组(40例)和短节段内固定组(44例)。短节段内固定组患者采用单纯后路短节段椎弓根螺钉内固定进行治疗,伤椎置钉组采用伤椎置钉联合后路短节段椎弓根螺钉内固定进行治疗。比较两组患者的手术时间、术中出血量、住院时间、伤椎前缘高度比、Cobb's角、伤椎椎体楔形变角、视觉模拟评分(VAS)和Oswestry功能障碍指数(ODI),炎症因子指标、脊髓损伤指标及术后并发症。**结果:**伤椎置钉组的手术时间长于短节段内固定组($P<0.05$),术后6个月、术后12个月伤椎置钉组的伤椎前缘高度比明显高于短节段内固定组,Cobb's角、伤椎椎体楔形变角明显低于短节段内固定组($P<0.05$),术前、术后1周、术后6个月、术后12个月两组患者的VAS评分和ODI比较差异无统计学意义($P>0.05$),术后3d两组患者血清中IL-1 β 、IL-6、IL-8、TNF- α 和pNF-H、NSE、S100 β 、GFAP水平比较差异均无统计学意义($P>0.05$)。随访期间两组患者均未出现严重并发症。**结论:**伤椎置钉联合后路短节段椎弓根螺钉内固定可有效改善胸腰椎爆裂性骨折患者的椎体高度、Cobb's角和伤椎椎体楔形变角,并且不会增加脊髓损伤和机体的炎症反应。

关键词:伤椎置钉;短节段内固定;胸腰椎爆裂性骨折;疗效;炎症因子;脊髓损伤

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Comparative Study of Injured Vertebra Combined with Short Segment Internal Fixation and Simple Short Segment Fixation in the Treatment of Thoracolumbar Burst Fracture*

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ABSTRACT Objective: To compare the clinical effect, the fixation effect and the effect on the inflammatory response and spinal cord injury of injured vertebra combined with short segment internal fixation and simple short segment fixation in the treatment of patients with thoracolumbar burst fracture. **Methods:** 94 patients with thoracolumbar burst fracture who were treated in our Hospital from March 2014 to December 2016 were selected, according to the different methods of operation, the patients were divided into the injured vertebra nailing group (40 cases) and the short segment internal fixation group (44 cases). Short segment internal fixation group was treated by simple posterior short segment pedicle screw internal fixation, the injured vertebra nailing group was treated with injured vertebra combined with posterior short segment internal fixation. The operation time, the amount of intraoperative bleeding, the time of hospitalization, the height ratio of the injured vertebra, the Cobb's angle, vertebral wedge angle, visual analogue scale(VAS), Oswestry disability index (ODI), inflammatory factor indexes, spinal cord injury indexes and postoperative complications of patients between the two groups were compared. **Results:** The operation time of the injured vertebral nailing group was longer than that of the short segment internal fixation group ($P<0.05$), at 6 months after operation and 12 months after operation, the height ratio of injured vertebrae in the injured vertebral nailing group was significantly higher than that in the short segment internal fixation group, Cobb's angle, vertebral wedge angle was significantly lower than that of short segment internal fixation group($P<0.05$). There was no significant difference in VAS score and ODI between two groups before operation, 1 weeks after operation, 6 months after operation and 12 months after operation ($P>0.05$). There was no significant difference in levels of serum IL-1 β , IL-6, IL-8, TNF- α and pNF-H, NSE, S100 β and GFAP between the two groups at 3 d after operation ($P>0.05$). During the follow-up period, the patients of two groups had no serious complications. **Conclusion:** The injured vertebra combined with posterior short segment fixation can effectively improve vertebral height, Cobb's angle and vertebral

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wedge angle of patients with thoracolumbar burst fracture, and it does not increase spinal cord injury and inflammatory response.

Key words: Injured vertebra; Short segment internal fixation; Thoracolumbar burst fracture; Curative effect; Inflammatory factors; Spinal cord injury

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前言

胸腰椎爆裂性骨折是胸腰椎骨折最常见的类型,随着近年来我国车辆的普及和建筑行业的高速发展,车祸、高处坠落、重物砸伤等事件的发生率随之增加,胸腰椎爆裂性骨折的发生率也出现明显的上升^[1]。胸腰椎爆裂性骨折患者受到高强度轴向暴力,使得脊柱解剖结构破坏、稳定型下降,并且常伴有骨折块突入椎管,造成脊髓、神经压迫性损伤^[2,3]。目前临床上治疗胸腰椎爆裂性骨折的方法有保守治疗和手术治疗,但保守治疗在后期易导致患者神经功能损伤加重、伤椎高度丢失,最后大部分保守治疗患者仍需转手术治疗^[4]。后路短节段椎弓根螺钉内固定是临床治疗胸腰椎爆裂性骨折的经典术式,因其具有手术适应症广、操作简单、手术创口小、患者术后骨折愈合时间短等优点,使其在临床上得到广泛的运用^[5,6]。然而随着后路短节段椎弓根螺钉内固定在临床的普及,其存在的缺陷也逐渐被暴露,主要表现为后凸畸形增加、内固定松动断裂、伤椎塌陷等^[7,8]。伤椎置钉是指在伤椎的完整的椎弓根上植入椎弓根螺钉,有研究结果显示^[9,10]伤椎置钉联合后路短节段椎弓根螺钉内固定可有效恢复患者椎体高度,防止矫正丢失。本研究旨在比较伤椎置钉联合短节段内固定与单纯短节段固定治疗胸腰椎爆裂性骨折的临床疗效、固定效果及其对患者炎症反应和脊髓损伤的影响,以为临床治疗胸腰椎爆裂性骨折时选择合适的术式提供参考,现报道如下。

1 资料与方法

1.1 一般资料

选取2014年3月到2016年12月期间我院收治的胸腰椎爆裂性骨折患者94例,纳入标准:(1)经CT、X线片检查确诊为胸腰椎爆裂性骨折;(2)均为单节椎体受损(T11-L2);(3)均为新鲜骨折;(4)均有明确的致伤原因;(5)均无脊髓神经功能损伤的临床表现,且CT显示骨块凸进椎管占位低于1/2,椎管内无翻转骨块,MRI检查显示脊髓无明显神经受压征象;(6)临床资料齐全;(7)患者及其家属对本研究内容知情同意,并已在知情同意书上签字。排除标准:(1)存在相关手术禁忌症者;(2)骨髓炎、骨肿瘤等疾病导致的病理性骨折者;(3)随访时间低于12个月者;(4)脊髓神经功能受损严重者;(5)合并有恶性肿瘤、严重器质性疾病、凝血功能障碍、免疫功能疾病、精神障碍疾病者;(6)合并四肢、骨盆等其他部位骨折者;(7)并发症如胸腔积液、创伤性湿肺者。根据手术方法的不同将患者分为伤椎置钉组(40例)和短节段内固定组(44例)。伤椎置钉组男性22例,女性18例,年龄27-68岁,平均年龄(43.58±8.51)岁,致伤原因:车祸23例,高处坠落13例,重物砸伤4例,受损部位:T11 8例,T12 8例,L1 12例,L2 12例,Denis分型:A型10例,B型30例,ASIA分级:D级35例,E级5例,TLICS评分4-7

分,平均(5.63±0.94)分。短节段内固定组男性24例,女性20例,年龄25-69岁,平均年龄(44.50±9.15)岁,致伤原因:车祸25例,高处坠落14例,重物砸伤5例,受损部位:T11 9例,T12 8例,L1 14例,L2 13例,Denis分型:A型11例,B型33例,ASIA分级:D级38例,E级6例,TLICS评分4-8分,平均(5.62±0.87)分。两组患者的性别、年龄、致伤原因、受损部位、Denis分型、ASIA分级、TLICS评分等比较无统计学差异($P>0.05$),可行组间比较。本研究已获得我院伦理委员会批准。

1.2 手术方法

1.2.1 短节段内固定组 患者采用单纯后路短节段椎弓根螺钉内固定进行治疗,患者全麻,取俯卧位,C型臂X线机定位,常规消毒铺巾,取后正中入路,以伤椎为中心,做一长度10cm左右的纵行切口,直至深筋膜,沿棘突剥离椎旁肌肉,使得伤椎及上下椎体棘突、椎板和关节突充分暴露,确定进钉点,依次开孔、扩孔、探壁,选择4枚长度、直径合适的椎弓根螺钉置入伤椎上下位椎体,安置连接棒,先锁定一端,采用C型臂X线机透视复位情况,复位满意后锁紧各螺钉,生理盐水反复冲洗,留置引流管,缝合切口,术毕。

1.2.2 伤椎置钉组 采用伤椎置钉联合后路短节段椎弓根螺钉内固定进行治疗,麻醉方法、患者体位、手术入路均与后路短节段椎弓根螺钉内固定一致,但需要在伤椎处置入2枚短于上下位椎体5-10mm的椎弓根螺钉,并在置入后适度的上下撬拨。

1.3 观察指标

1.3.1 围手术指标 比较两组患者的手术时间、术中出血量、住院时间。

1.3.2 疗效评估 在术前、术后1周、术后6个月、术后12个月检测患者的伤椎前缘高度比、Cobb's角、伤椎椎体楔形变角、视觉模拟评分(VAS)^[11]和Oswestry功能障碍指数(ODI)^[12]。其中伤椎前缘高度比=实测伤椎前缘高度/伤椎前缘相对正常高度×100%,而伤椎前缘相对正常高度=(伤椎上位椎体前缘高度+伤椎下位椎体前缘高度)/2。Cobb's角的测量方法为:在伤椎上位椎体的上终板和下位椎体的下终板各做一条水平延长线,分别对两延长线做一条垂线,两垂线相交形成的锐角即为Cobb's角。伤椎椎体楔形变角测量方法:在伤椎的上、下终板各作一水平延长线,两条延长线相交形成的锐角即为伤椎椎体楔形变角。VAS评测方法如下:画一条水平线,在线上标上0-10的刻度,其中0端代表无痛,10端代表剧痛,让患者根据主观感受在直线上做标记,标记点的所在位置即为对应的VAS评分。ODI总共包括10个问题,每个问题根据选项给予0-5分,满分为50分,ODI=实际得分/50×100%,ODI越大则代表功能障碍越明显。

1.3.3 血清学指标的检测 在术后3d抽取两组患者的空腹外周静脉血5mL,于室温中静置1h,采用3000r/min的离心速度进行10min的离心运动,提取上层血清,置于-20℃的冰箱

中保存待测。采用酶联免疫吸附法检测患者血清中白细胞介素 1 β (IL-1 β)、白细胞介素 6(IL-6)、白细胞介素 8(IL-8)、肿瘤坏死因子- α (TNF- α)、磷酸化高分子量神经微丝蛋白(pNF-H)、神经元特异性烯醇化酶(NSE)、星形胶质原性钙结合蛋白(S100 β)、胶质纤维酸性蛋白(GFAP)的表达水平。检测试剂盒均购于美国 Sigma-Aldrich 公司,检测步骤严格参照试剂盒说明书进行。

1.3.4 并发症 所有患者术后接受长于 12 个月的随访,随访方式主要为定期复诊(术后 6 个月、术后 12 个月)和电话随访,记录患者的并发症发生率。

1.4 统计学方法

使用 SPSS18.0 统计学软件处理数据。观测资料主要为计量资料,用($\bar{x} \pm s$)表示,两组间采用成组 t 检验,组内比较采用配对 t 检验。多时点重复观测资料则行重复测量方差分析。部分计数资料,采用百分率(%)表示,采用 χ^2 检。若 $P < 0.05$,则差异有统计学意义。

2 结果

2.1 两组患者的围手术指标比较

两组患者的术中出血量、住院时间比较差异无统计学意义($P > 0.05$);伤椎置钉组的手术时间长于短节段内固定组,差异有统计学意义($P < 0.05$),见表 1。

表 1 两组患者的围手术指标比较

Table 1 Comparison of perioperative indicators between two groups of patients

Groups	n	Operation time(min)	Amount of intraoperative bleeding(mL)	Time of hospitalization(d)
Injured vertebra nailing group	40	89.66 $\pm$ 15.32	167.67 $\pm$ 33.86	13.35 $\pm$ 2.88
Short segment internal fixation group	44	78.21 $\pm$ 16.56	156.01 $\pm$ 31.54	14.19 $\pm$ 2.63
T value	-	3.269	1.518	1.309
P value	-	0.003	0.076	0.147

2.2 两组患者不同时间点的影像学检查结果比较

术前、术后 1 周两组患者的伤椎前沿高度比、Cobb's 角、伤椎椎体楔形变角比较差异无统计学意义($P > 0.05$),术后 1 周、术后 6 个月、术后 12 个月两组患者的伤椎前沿高度比均明显高于术前,Cobb's 角、伤椎椎体楔形变角均明显低于术前,差异

有统计学意义($P < 0.05$);术后 6 个月、术后 12 个月伤椎置钉组的伤椎前沿高度比明显高于短节段内固定组,Cobb's 角、伤椎椎体楔形变角明显低于短节段内固定组,差异有统计学意义($P < 0.05$),见表 2。

表 2 两组患者不同时间点的影像学检查结果比较

Table 2 Comparison of imaging findings at different time points between two groups

Groups	Time	Height ratio of the injured vertebra(%)	Cobb's angle($^{\circ}$)	Vertebral wedge angle($^{\circ}$)
Injured vertebra nailing group(n=40)	Before operation	59.59 $\pm$ 6.35	20.63 $\pm$ 2.36	25.62 $\pm$ 7.55
	1 weeks after operation	94.60 $\pm$ 4.66 ^b	3.22 $\pm$ 1.25 ^b	2.21 $\pm$ 0.84 ^b
	6 months after operation	92.83 $\pm$ 4.12 ^b	3.42 $\pm$ 1.54 ^b	3.23 $\pm$ 1.03 ^b
	12 months after operation	89.60 $\pm$ 5.16 ^b	3.96 $\pm$ 1.64 ^b	6.51 $\pm$ 3.22 ^b
Short segment internal fixation group(n=44)	Before operation	60.02 $\pm$ 6.41	20.13 $\pm$ 2.24	26.20 $\pm$ 7.32
	1 weeks after operation	93.62 $\pm$ 4.58 ^b	3.31 $\pm$ 1.28 ^b	2.32 $\pm$ 0.79 ^b
	6 months after operation	88.98 $\pm$ 4.21 ^{ab}	4.12 $\pm$ 1.87 ^{ab}	4.14 $\pm$ 1.16 ^{ab}
	12 months after operation	84.69 $\pm$ 4.93 ^{ab}	4.83 $\pm$ 1.82 ^{ab}	7.86 $\pm$ 2.65 ^{ab}
Holistic analysis	HF coefficient	0.9107	0.9041	0.4780
Comparison among groups	F,P	13.523,0.000	1.716,0.175	2.428,0.109
Time-point comparison	F,P	47.269,0.000	32.561,0.000	19.284,0.000
Group $\times$ time point	F,P	5.802,0.004	2.946,0.067	0.365,0.458

Note: Comparison of two groups at the same time, ^a $P < 0.05$, Comparisons with before operation, ^b $P < 0.05$.

2.3 两组患者不同时间点的 VAS 评分和 ODI 比较

各时间点两组患者的 VAS 评分和 ODI 组间比较差异无统计学意义($P > 0.05$),术后 1 周、术后 6 个月、术后 12 个月两

组患者的 VAS 评分和 ODI 均明显低于术前,差异均有统计学意义($P < 0.05$),见表 3。

表 3 两组患者不同时间点的 VAS 评分和 ODI 比较

Table 3 Comparison of VAS score and ODI at different time points between two groups

Groups	Time	VAS score	ODI(%)
Injured vertebra nailing group (n=40)	Before operation	8.41± 1.24	88.66± 8.61
	1 weeks after operation	4.62± 1.45 ^b	63.38± 7.70 ^b
	6 months after operation	1.96± 0.96 ^b	25.23± 5.24 ^b
	12 months after operation	1.83± 0.98 ^b	22.52± 4.63 ^b
Short segment internal fixation group(n=44)	Before operation	8.32± 1.36	87.91± 8.86
	1 weeks after operation	4.58± 1.51 ^b	64.58± 7.50 ^b
	6 months after operation	2.04± 0.91 ^b	26.61± 6.01 ^b
	12 months after operation	1.94± 1.03 ^b	23.16± 4.92 ^b
Holistic analysis	HF coefficient	0.9363	0.8752
Comparison among groups	F,P	0.026,0.857	0.528,0.396
Time-point comparison	F,P	32.691,0.000	52.743,0.000
Group× time point	F,P	0.135,0.798	0.438,0.619

Note: Comparisons with before operation, ^b $P<0.05$.

2.4 两组患者的术后 3 d 血清中炎症因子和脊髓损伤指标的比较

术后 3 d 两组患者血清中的炎症因子(IL-1 β 、IL-6、IL-8、

TNF- α)和脊髓损伤指标(pNF-H、NSE、S100 β 、GFAP)水平比较差异均无统计学意义($P>0.05$)。见表 4。

表 4 两组患者的术后 3 d 血清中炎症因子和脊髓损伤指标的比较

Table 4 Comparison of inflammatory factors and spinal cord injury indexes in serum of two groups 3 days after operation

Groups	Inflammatory factors			Spinal cord injury indexes				
	IL-1 β (ng/mL)	IL-6(pg/mL)	IL-8(pg/mL)	TNF- α (ng/mL)	pNF-H (ng/mL)	NSE(ng/mL)	S100 β (ng/mL)	GFAP (ng/mL)
Injured vertebra nailing group(n=40)	9.26± 1.13	19.94± 2.19	16.96± 2.63	4.73± 0.67	0.53± 0.09	9.26± 1.23	1.73± 0.33	4.31± 0.58
Short segment internal fixation group(n=44)	9.32± 1.08	20.08± 2.24	17.12± 2.57	4.81± 0.69	0.54± 0.08	9.41± 1.19	1.81± 0.29	4.44± 0.62
T value	0.247	0.283	0.271	0.546	0.516	0.569	1.238	1.153
P value	0.816	0.759	0.785	0.502	0.572	0.554	0.213	0.356

2.5 两组患者并发症比较

两组患者术中均未出现神经及血管损伤等严重并发症,术后两组均未出现切口浅表感染、深静脉血栓等并发症。伤椎置钉组术后随访 12-20 个月,平均(16.42± 2.61)个月,短节段内固定组术后随访 12-21 个月,平均(17.15± 2.73)个月,均未出现内固定物弯曲、松动、断钉、断棒等严重并发症。

3 讨论

胸腰椎爆裂性骨折是常见骨科疾病,通常由高强度轴向暴力所致^[13-15]。临床上治疗胸腰椎爆裂性骨折的基本原则是重建脊柱稳定性和生理曲度,恢复患者的脊髓、神经功能,提高患者的生活质量^[16,17]。后路椎弓根螺钉内固定是治疗胸腰椎爆裂性骨折的常用方法,临床可分为后路长节段椎弓根螺钉内固定和后路短节段椎弓根螺钉内固定,其中长节段可分散单个螺钉所承受的应力,固定效果好,然而长节段固定会明显影响脊柱的运动节段,导致其活动度降低^[18]。短节段固定只需要在伤椎上

下位椎体置入螺钉,可较好的保留脊柱活动度,且手术创伤较小,患者术后恢复快,然而短节段的固定强度较差,导致术后远期疗效欠佳^[19,21]。为了在保留脊柱活动度的同时增加固定强度,有学者提出了“伤椎置钉”的理念^[22,23],即在短节段椎弓根螺钉内固定的基础上于损伤椎体的完整椎弓根内置入螺钉,以起到增强固定强度的作用。

伤椎置顶需在损伤椎体置入螺钉,在后路短节段椎弓根螺钉内固定上增加了一些手术步骤,因此其手术时间会有所增加,本研究结果也显示,伤椎置钉组的手术时间长于短节段内固定组。此外,两组患者的术中出血量、住院时间比较差异无统计学意义,说明两组术式的术中出血量和短期恢复速度无明显差异。胸腰椎爆裂性骨折患者术后椎体高度丢失、Cobb's 角和伤椎椎体楔形变角增加是导致患者远期疗效下降的重要原因,本研究结果显示,术后 1 周、术后 6 个月、术后 12 个月两组患者的伤椎前缘高度均明显高于术前,Cobb's 角、伤椎椎体楔形变角均明显低于术前;术后 6 个月、术后 12 个月伤椎置钉组

优于短节段内固定组,这说明两种手术方法均可明显改善胸腰椎爆裂性骨折患者的椎体高度、Cobb's 角和伤椎椎体楔形变角,而伤椎置钉联合后路短节段椎弓根螺钉内固定的远期固定效果明显优于单纯后路短节段椎弓根螺钉内固定。后路短节段椎弓根螺钉内固定通过置入邻椎的椎弓根螺钉形成四边形固定,牵拉椎间盘,恢复椎体高度、纠正 Cobb's 角和伤椎椎体楔形变角,然而四边形固定抗旋转性差,侧向不稳,且在伤椎上缺乏支撑点,伤椎上下位椎体的螺钉承担了主要的负荷,进而导致其固定强度较差,远期固定效果欠佳^[24-26]。而伤椎置钉类似于三平面固定,可分散各个螺钉承受的应力,增强固定效果,同时伤椎中的螺钉可起到一定的撬拨效果,有利于伤椎高度恢复和维持^[27-29]。本研究结果还显示,术后 1 周、术后 6 个月、术后 12 个月两组患者的 VAS 评分和 ODI 均明显低于术前,差异均有统计学意义;说明两种手术方法改善胸腰椎爆裂性骨折患者的疼痛程度和腰椎功能无明显差别。刘潮坚^[30]等人的研究结果也显示,伤椎置钉的固定强度更佳,但近期临床疗效与后路短节段椎弓根螺钉内固定相当。尽管伤椎置钉治疗胸腰椎爆裂性骨折的效果已经得到了大量研究的证实,但伤椎置钉需要多增加两枚螺钉,可能会增加脊髓创伤,进而导致患者全身的炎症反应增强,影响患者恢复。IL-1 β 、IL-6、IL-8、TNF- α 均是衡量炎症反应程度的常用指标,而 pNF-H、NSE、S100 β 、GFAP 是常见的脊髓损伤指标。本研究结果显示,术后 3 d 两组患者血清中的炎症因子(IL-1 β 、IL-6、IL-8、TNF- α)和脊髓损伤指标(pNF-H、NSE、S100 β 、GFAP)水平比较差异均无统计学意义,这说明伤椎置钉并不会明显的增加患者的脊髓损伤和机体的炎症反应。术后随访发现两组患者均未出现严重的并发症,这可能是由于随访时间过短,在后续的研究中应增加随访时间,以更好的比较两种术式的远期疗效。同时,本研究选取的病例数较少,可能会对结果造成一定的影响,后续研究中将增加病例数,以减少此类误差。

综上所述,单纯后路短节段椎弓根螺钉内固定与伤椎置钉联合后路短节段椎弓根螺钉内固定均能有效治疗胸腰椎爆裂性骨折,但后者手术时间较长,然而可有效改善胸腰椎爆裂性骨折患者的椎体高度、Cobb's 角和伤椎椎体楔形变角,并且不会增加脊髓损伤和机体的炎症反应。然而伤椎置钉手术适应症较后路短节段椎弓根螺钉内固定更窄,如患者伤椎双侧椎弓根骨折或椎弓根没有完全断裂则不宜行伤椎置钉,因此临床应根据具体情况来选择合适的术式。

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