·临床研究·

单球囊单、双侧扩张经皮椎体后凸成形术治疗骨质疏松性椎体压缩骨折的比较

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摘　要　**目的**:比较单球囊单、双侧扩张经皮椎体后凸成形术治疗骨质疏松性椎体压缩骨折的临床疗效和安全性。**方法**:回顾性分析接受单球囊扩张经皮椎体后凸成形术治疗的 44 例骨质疏松性椎体压缩骨折患者的病例资料,男 9 例,女 35 例;年龄 61 ~ 89 岁,中位数 72 岁;均为单节段椎体压缩骨折;骨折部位,T_{10}2 例、T_{11}6 例、T_{12}14 例、$L_1$15 例、$L_2$6 例、$L_3$1 例;单侧扩张 22 例,双侧扩张 22 例。对 2 组手术时间、X 线曝光次数、骨水泥注入量、骨水泥渗漏率、疼痛视觉模拟评分、伤椎前缘高度丢失百分比、伤椎中部高度丢失百分比、Cobb 角进行比较。**结果**:2 组患者均顺利完成手术,单侧经皮椎体后凸成形术组较双侧经皮椎体后凸成形术组手术时间短、X 线曝光次数少、骨水泥注入量少[(32.60 ± 9.51) min,(49.70 ± 10.87) min,t = 3.742,P = 0.002;(15.50 ± 8.37) 次,(25.70 ± 9.87) 次,t = 2.982,P = 0.008;(3.38 ± 0.83) mL,(6.01 ± 1.21) mL;t = 5.664,P = 0.000]。术后 X 线及 CT 检查显示,双侧经皮椎体后凸成形术组骨水泥呈团块状分布于伤椎两侧或均匀弥散,单侧经皮椎体后凸成形术组骨水泥偏一侧呈团块状分布或越过中线弥散分布。2 组患者均获随访,随访时间 8 ~ 18 个月,中位数 11.5 个月;骨折均愈合,愈合时间 3 ~ 6 个月,中位数 4.5 个月。术前 2 组患者疼痛视觉模拟评分、伤椎前缘高度丢失百分比、伤椎中部高度丢失百分比及 Cobb 角的组间差异均无统计学意义[(8.518 ± 1.921) 分,(8.786 ± 1.580) 分;t = 0.505,P = 0.616;(29.727 ± 4.524)%,(30.261 ± 4.192)%;t = 0.406,P = 0.687;(24.750 ± 3.872)%,(25.022 ± 4.682)%;t = 0.210,P = 0.835;24.543° ± 4.021°,25.121° ± 3.954°;t = 0.481,P = 0.633]。术后 1 d,2 组患者疼痛缓解,疼痛视觉模拟评分均较术前降低(t = 25.561,P = 0.000;t = 35.927,P = 0.000);伤椎前缘高度丢失百分比、伤椎中部高度丢失百分比及 Cobb 角均较术前减小(t = 42.400,P = 0.000;t = 38.572,P = 0.000;t = 47.929,P = 0.000;t = 27.563,P = 0.000;t = 38.627,P = 0.000;t = 31.531,P = 0.000);但 2 组间以上各项疗效评价指标比较,差异均无统计学意义[(2.886 ± 1.205) 分,(2.846 ± 1.137) 分;t = 0.113,P = 0.910;(11.546 ± 2.903)%,(10.983 ± 3.439)%;t = 0.587,P = 0.561;(10.159 ± 2.648)%,(9.637 ± 2.371)%;t = 0.688,P = 0.495;9.872° ± 2.361°,9.214° ± 1.859°;t = 1.027,P = 0.310]。单侧经皮椎体后凸成形组术后并发骨水泥渗漏 3 例,双侧经皮椎体后凸成形组术后并发骨水泥渗漏 2 例,均无神经脊髓损伤、肺栓塞等并发症发生,未予特殊处理;2 组患者骨水泥渗漏发生率比较,差异无统计学意义(χ^2 = 0.000,P = 1.000)。**结论**:单球囊单、双侧扩张经皮椎体后凸成形术治疗骨质疏松性椎体压缩骨折均能有效缓解疼痛、恢复伤椎高度、纠正脊柱畸形,疗效相当,并发症少。但单侧扩张手术时间更短、X 线曝光次数及骨水泥注入量更少,更适合于高龄体弱难以耐受长时间俯卧的患者。

关键词　脊柱骨折　椎体后凸成形术　骨质疏松性骨折

The clinical comparison of unilateral and bilateral dilatation percutaneous kyphoplasty with single balloon for treatment of osteoporotic vertebral compression fractures

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ABSTRACT　**Objective**: To compare the clinical curative effect and safety of unilateral versus bilateral dilatation percutaneous kyphoplasty (PKP) with single balloon for treatment of osteoporotic vertebral compression fractures (OVCF). **Methods**: The medical records of 44 patients with single - segment OVCF treated with single balloon PKP were analyzed retrospectively. The patients consisted of 9 males and 35 females, and ranged in age from 61 to 89 years (Mean = 72 yrs). The fractures located in T_{10} (2), T_{11} (6), T_{12} (14), L_1 (15), L_2 (6) and L_3 (1). Unilateral dilatation PKP was performed in 22 patients and bilateral dilatation PKP was performed in 22 patients. Then the two groups were compared with each other in such parameters as operative time, frequency of X-ray exposure, consumption of bone cement, incidence rate of bone cement leakage, visual analogue scores (VAS), loss of anterior border and middle height of injured vertebrae and kyphosis Cobb angle. **Results**: The surgery were performed successfully in all the patients and. the unilateral PKP had shorter operative time, fewer X-ray exposure and less consumption of bone cement than did bilateral PKP (32.60 +/- 9.51 vs 49.70 +/- 10.87 min, t = 3.742, P = 0.002; 15.50 +/- 8.37 vs 25.70 +/- 9.87, t = 2.982, P = 0.008; 3.38 +/- 0.83 vs 6.01 +/- 1.21 mL; t = 5.664, P = 0.000). Postoperative X-ray and CT examination showed that the bone cements were well-distributed or distributed in clumps in both sides of injured vertebra in

bilateral PKP group, while the bone cements were distributed in clumps in one side of injured vertebra or dispersed across the midline in unilateral PKP group. The patients in the 2 groups were all followed up for 8 – 18 months with a median of 11.5 months. All fractures united between 3 and 6 weeks with a median of 4.5 weeks. There was no statistical difference in VAS, percentage of loss of injured vertebrae anterior border and middle height of injured vertebrae and kyphosis Cobb angle between the 2 groups before the treatment (8.518 +/– 1.921 vs 8.786 +/– 1.580 points; $t = 0.505$, $P = 0.616$; 29.727 +/– 4.524% vs 30.261 +/– 4.192%; $t = 0.406$, $P = 0.687$; 24.750 +/– 3.872% vs 25.022 +/– 4.682%; $t = 0.210$, $P = 0.835$; 24.543 +/– 4.021 vs 25.121 +/– 3.954 degrees; $t = 0.481$, $P = 0.633$). One day after the surgery, the pain was relieved and the postoperative VAS scores were lower than the preoperative VAS scores in the two groups ($t = 25.561$, $P = 0.000$; $t = 35.927$, $P = 0.000$). The percentage of loss of injured vertebrae anterior border height, percentage of loss of injured vertebrae middle height and kyphosis Cobb angle decreased ($t = 42.400$, $P = 0.000$; $t = 38.572$, $P = 0.000$; $t = 47.929$, $P = 0.000$; $t = 27.563$, $P = 0.000$; $t = 38.627$, $P = 0.000$; $t = 31.531$, $P = 0.000$). However, there were no statistical differences between the 2 groups in all the therapeutic effect assessment indicators (2.886 +/– 1.205 vs 2.846 +/– 1.137 points; $t = 0.113$, $P = 0.910$; 11.546 +/– 2.903% vs 10.983 +/– 3.439%; $t = 0.587$, $P = 0.561$; 10.159 +/– 2.648% vs 9.637 +/– 2.371%; $t = 0.688$, $P = 0.495$; 9.872 +/– 2.361 vs 9.214 +/– 1.859 degrees; $t = 1.027$, $P = 0.310$). The bone cement leakage were found after the surgery in three patients in unilateral PKP group and in two patients in bilateral PKP group and no treatment were performed. No complications such as nerve injury, spinal cord injury and pulmonary embolism were found in the two groups. There was no statistical difference in the incidence rate of bone cement leakage between the 2 groups ($\chi^2 = 0.000$, $P = 1.000$). **Conclusion**: Unilateral dilatation PKP with single balloon is similar to bilateral dilatation PKP with single balloon in the effect on pain relief, injured vertebral height restoration and spinal deformity correction, with few complications. However, unilateral dilatation PKP has the advantage of shorter operative time, fewer X-ray exposure and less bone cement consumption, therefore it is more suitable to weak and aged patients who can not withstand prolonged face lying.

Key words　Spinal fractures; Kyphoplasty; Osteoporotic fractures

随着老龄化社会的到来，骨质疏松性椎体压缩骨折（osteoporotic vertebral compression fractures，OVCF）的发病呈逐渐上升趋势。经皮椎体后凸成形术（percutaneous kyphoplasty，PKP）可迅速缓解疼痛、恢复正常脊柱序列，是目前手术治疗骨质疏松性椎体压缩骨折的首选方法[1-2]。笔者对 2009 年 1 月至 2011 年 1 月采用单球囊单侧扩张PKP和单球囊双侧扩张PKP治疗的 44 例 OVCF 患者的病例资料进行了回顾性分析，对 2 种方法的疗效和安全性进行了比较，现报告如下。

1　临床资料

骨质疏松性椎体压缩骨折患者 44 例，男 9 例，女 35 例；年龄 61 ~ 89 岁，中位数 72 岁；均为单节段椎体压缩骨折。2 组患者基线资料比较，差异无统计学意义，具有可比性（表 1）。

表 1　2 组骨质疏松性椎体压缩骨折患者基线资料比较

组别	年龄（岁）	性别（例）		骨折部位（例）					
		男	女	T_{10}	T_{11}	T_{12}	L_1	L_2	L_3
单侧 PKP 组	72.3 ± 5.4	5	17	1	3	6	8	3	1
双侧 PKP 组	73.1 ± 5.3	4	18	1	3	8	7	3	0
检验统计量	$t = 0.494$	$\chi^2 = 0.000$							
P 值	0.624	1.000				1.000			

2　方　法

2.1　治疗方法　采用局部浸润麻醉或静脉-吸入复合麻醉，患者俯卧位。C 形臂 X 线机透视下定位，骨折椎体无“双边影”，两侧椎弓根形状对称并与棘突的间距相等。单侧 PKP 组，自伤椎症状严重侧椎弓根外上缘，用穿刺针由外上向内下穿至椎体后缘前方 3 mm处，抽出穿刺针内芯，置入导针后拔除穿刺针，沿导针置入扩张管和工作套管，建立工作通道。透视下使用精细钻扩孔，置入球囊，扩张球囊至椎体高度恢复满意或球囊达终板时停止。双侧 PKP 组，由两位医师分别从伤椎两侧椎弓根外上缘同时穿刺建立工作通道，置入球囊，先扩张一侧，再扩张另一侧。球囊扩张后，缓慢注入调和至拉丝状态的聚甲基丙烯酸甲酯骨水泥，透视下见骨水泥弥散至椎体后缘时停止注射。拔出套管，缝合切口。术后 48 h 下床活动，适当腰背肌功能锻炼，并继续进行抗骨质疏松治疗。

2.2 疗效评价方法 手术前后，采用疼痛视觉模拟评分（visual analogue scale，VAS）法对患者疼痛情况进行评估；在 X 线侧位片上测量 2 组患者伤椎前缘、中部高度及 Cobb 角，计算伤椎高度丢失百分比。

2.3 统计学方法 采用 SPSS14.0 统计软件处理数据，2 组患者年龄、手术时间、X 线曝光次数、骨水泥注入量及各项疗效评价指标的组间比较采用 t 检验，骨折部位的组间比较采用确切概率法检验；性别、骨水泥渗漏发生率的组间比较采用校正 χ^2 检验；检验水准 $\alpha=0.05$。

3 结 果

2 组患者均顺利完成手术，与双侧 PKP 组相比，单侧 PKP 组手术时间短、X 线曝光次数少、骨水泥注入量少（表 2）。术后 X 线及 CT 检查示：单侧 PKP 组，骨水泥偏一侧呈团块状分布或越过中线弥散分布；双侧 PKP 组，骨水泥呈团块状分布于伤椎两侧或均匀弥散。2 组患者均获随访，随访时间 8 ~ 18 个月，中位数 11.5 个月；骨折均愈合，愈合时间 3 ~ 6 个月，中位数 4.5 个月。术前 2 组患者 VAS 评分、伤椎前缘高度丢失百分比、伤椎中部高度丢失百分比及 Cobb 角的组间差异均无统计学意义（表 3）。术后 1 d，2 组患者疼痛缓解，VAS 评分降低（$t=25.561$，$P=0.000$；$t=35.927$，$P=0.000$）；伤椎前缘高度丢失百分比、伤椎中部高度丢失百分比及 Cobb 角均较治疗前减小（$t=42.400$，$P=0.000$；$t=38.572$，$P=0.000$；$t=47.929$，$P=0.000$；$t=27.563$，$P=0.000$；$t=38.627$，$P=0.000$；$t=31.531$，$P=0.000$）；但 2 组间以上各项疗效评价指标比较，差异均无统计学意义（表 4）。单侧 PKP 组术后并发骨水泥渗漏 3 例，双侧 PKP 组术后并发骨水泥渗漏 2 例，均无神经脊髓损伤、肺栓塞等并发症发生，未予特殊处理；2 组患者骨水泥渗漏发生率比较，差异无统计学意义（$\chi^2=0.000$，$P=1.000$）。典型病例 X 线片见图 1、图 2。

表 2 2 组骨质疏松性椎体压缩骨折患者手术一般情况比较

组别	手术时间（min）	X 线曝光次数（次）	骨水泥注入量（mL）
单侧 PKP 组	32.60 ± 9.51	15.50 ± 8.37	3.38 ± 0.83
双侧 PKP 组	49.70 ± 10.87	25.70 ± 9.87	6.01 ± 1.21
t 值	3.742	2.982	5.664
P 值	0.002	0.008	0.000

表 3 2 组骨质疏松性椎体压缩骨折患者术前 VAS 评分、伤椎高度丢失百分比及 Cobb 角比较

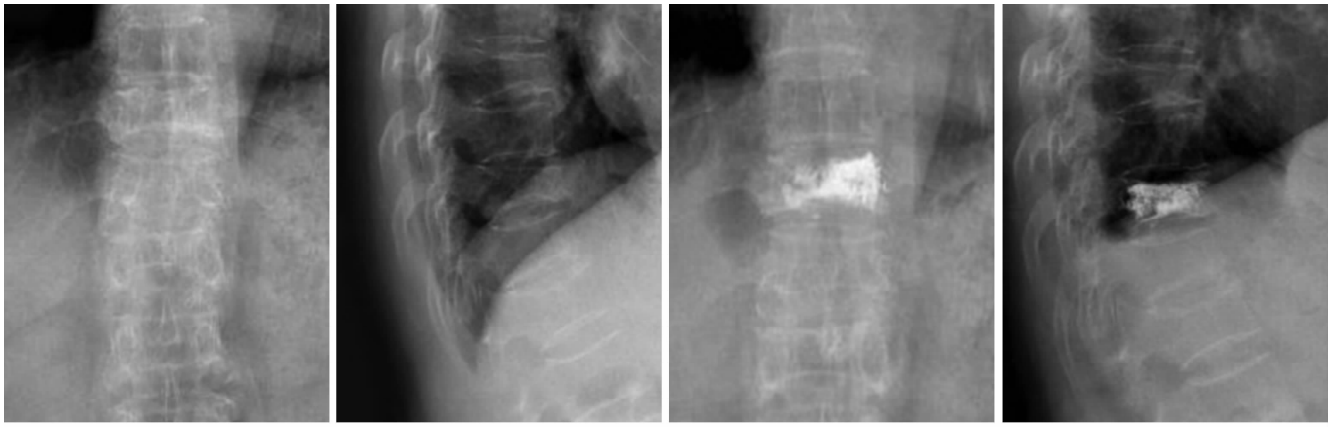
组别	VAS 评分（分）	伤椎前缘高度丢失百分比（%）	伤椎中部高度丢失百分比（%）	Cobb 角（°）
单侧 PKP 组	8.518 ± 1.921	29.727 ± 4.524	24.750 ± 3.872	24.543 ± 4.021
双侧 PKP 组	8.786 ± 1.580	30.261 ± 4.192	25.022 ± 4.682	25.121 ± 3.954
t 值	0.505	0.406	0.210	0.481
P 值	0.616	0.687	0.835	0.633

表 4 2 组骨质疏松性椎体压缩骨折患者术后 1 dVAS 评分、伤椎高度丢失百分比及 Cobb 角比较

组别	VAS 评分（分）	伤椎前缘高度丢失百分比（%）	伤椎中部高度丢失百分比（%）	Cobb 角（°）
单侧 PKP 组	2.886 ± 1.205	11.546 ± 2.903	10.159 ± 2.648	9.872 ± 2.361
双侧 PKP 组	2.846 ± 1.137	10.983 ± 3.439	9.637 ± 2.371	9.214 ± 1.859
t 值	0.113	0.587	0.688	1.027
P 值	0.910	0.561	0.495	0.310

4 讨 论

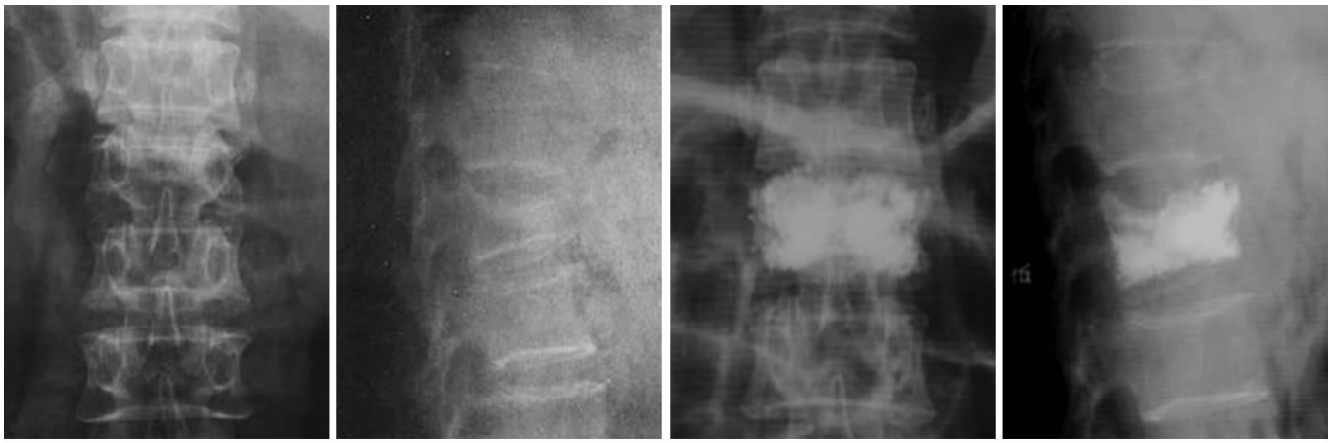
PKP 手术通过球囊扩张恢复伤椎高度后，在椎体内形成了 1 个相对密闭的空腔，在低压条件下注入黏稠度较高的骨水泥，可维持伤椎高度，大大降低骨水泥渗漏的风险。经典 PKP 手术采用双侧穿刺双球囊扩张，价格昂贵。而采用双侧穿刺单球囊扩张进行 PKP 手术，骨水泥分布均匀，也可有效恢复椎体高度、缓解疼痛[3]。也有学者认为单侧或双侧经椎弓根穿刺 PKP 对椎体强度、高度变化的影响，差异并无统计学意义[4]。张永平等[5]采用单侧穿刺椎体后凸成形术治疗 OVCF，疗效满意。但 Liebschner 等[6]通过三维有限元模型分析认为，尽管经单侧和双侧椎弓根穿刺注射骨水泥进行椎体后凸成形术均可恢复椎体强度和刚度，但经单侧椎弓根注射会造成骨水泥在椎体



(1)　(2)　(3)　(4)

图 1　患者,女,82 岁,T_{11} 骨质疏松性椎体压缩骨折

(1)术前 X 线正位片　(2)术前 X 线侧位片　(3)单侧 PKP 术后 12 个月 X 线正位片　(4)单侧 PKP 术后 12 个月 X 线侧位片



(1)　(2)　(3)　(4)

图 2　患者,女,70 岁,L_1 骨质疏松性椎体压缩骨折

(1)术前 X 线正位片　(2)术前 X 线侧位片　(3)双侧 PKP 术后 12 个月 X 线正位片　(4)双侧 PKP 术后 12 个月 X 线侧位片

内分布不均匀,椎体单侧承重而导致脊柱不稳,在恒定载荷下脊柱易向对侧弯曲,造成椎体压缩变形。因此,在单侧 PKP 手术中,穿刺时可适当增加穿刺针的倾斜角度,使球囊置入后尽量接近或越过椎体中线,但在 X 线正位透视下针尖不可越过椎弓根内壁,以防止骨水泥渗入椎管。骨水泥渗漏是 PKP 术后的主要并发症,发生率为 7% ~15%[7-8]。本研究中,2 组患者术后均出现了骨水泥渗漏,可能与伤椎椎体前方或侧方压缩部分经扩张复位后产生裂隙有关,术中应注意缓慢推注骨水泥,透视下发现骨水泥渗漏后应立即停止注射,待骨水泥稍凝固后再继续推注。

本研究结果表明,单球囊单、双侧扩张 PKP 治疗骨质疏松性椎体压缩骨折均可有效缓解疼痛、恢复伤椎高度和正常脊柱序列,疗效相当,并发症少。但单侧 PKP 手术时间更短、X 线曝光次数及骨水泥注入量更少,更适合于高龄体弱及难以耐受长时间俯卧的患者。

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(下转第 29 页)

(上接第 24 页)

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