

骨质疏松性椎体压缩骨折合并腰椎退变性疾病的治疗策略及疗效观察

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摘要: **目的** 探讨椎体后凸成形术结合后外侧融合术治疗骨质疏松性椎体压缩骨折 (Osteoporotic vertebral compression fractures OVCFs) 合并腰椎退变性疾病 (lumbar degenerative diseases, LDD) 的临床疗效。**方法** 收集本院 2007 年 5 月至 2009 年 6 月间, 12 例 OVCFs (男 5 例, 女 7 例) 合并不同程度 LDD 的患者, 依据患者术前症状、体征结合 X 线片、CT 及 MRI 进行综合分析, 采用一期后路腰椎间盘切除、椎体后外侧融合 (Posterolateral fusion PLF) + 伤椎椎体后凸成形术 (Percutaneous kyphoplasty, PKP) 治疗。采用 JOA 评分评估患者腰背痛及下肢神经功能的恢复情况; SF-36 健康调查评分表评估患者生活质量; 定期拍摄脊柱正侧位 X 线片、CT 和/或 MRI 评估患者术后骨折椎体复位、后凸矫正及并发症发生情况。**结果** 12 例患者均顺利完成手术。平均手术时间 170 min, 平均骨水泥注射量 5.3 ml, 术后随访 12~36 个月, 平均 25 个月, 所有患者腰背痛及患肢神经症状明显缓解, 椎体前缘高度和后凸角度术前分别为 13.2 ± 2.8 mm 和 $29.7^\circ \pm 10.5^\circ$, 术后分别为 21.8 ± 3.4 mm 和 $16.2^\circ \pm 8.4^\circ$, 椎体后缘高度术前、术后和随访期间均无显著变化; 术前及末次随访时 JOA 评分分别为 9.46 ± 2.58 和 21.52 ± 3.55 , 手术前后有显著性差异 ($P < 0.05$), 随访过程中未发现椎体高度再丢失、后凸畸形加重及患肢神经症状的复发。患者 SF-36 健康调查评分术后均有显著提高。1 例患者术中出现骨水泥渗漏, 术后未出现临床症状。**结论** OVCFs 合并 LDD, 采用 PLF + PKP 治疗, 能够使患者腰背痛及患肢神经症状明显缓解并可早期下地活动、功能锻炼, 减少长期卧床并发症, 是一种安全、有效的治疗方法。

关键词: 骨质疏松性椎体压缩骨折; 腰椎退变性疾病; 椎体后凸成形术; 椎体后外侧融合术

Treatment strategy and efficacy observation of osteoporotic vertebral compression fractures combined with lumbar degenerative diseases

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Abstract: **Objective** To investigate the efficacy of percutaneous kyphoplasty (PKP) and posterolateral fusion (PLF) for the treatment of osteoporotic vertebral compression fractures (OVCFs) combined with lumbar degenerative diseases (LDD). **Methods** A total of 12 patients, who had OVCFs combining with different degrees of LDD from May 2007 to Jun 2009, including 5 men and 7 women, were involved in this study. The clinical data of all the patients were analyzed, including preoperative symptoms and manifestations, the results of X-ray, CT, and MRI. The patients received PKP with PLF. Preoperative and postoperative pain level, JOA score and SF-36 score, vertebral height restoration, and local kyphosis correction and complications were recorded and analyzed. **Results** The operations of 12 patients were successful, with an average operation time of 170 minutes and an average 5 ml injection of bone cement. All the cases were followed up for an average of 25 months (from 12 to 36 months). The back pain of all the patients and the nerve symptoms of affected limbs relived significantly. The mean height of anterior and local kyphosis correction before the operation were 13.2 ± 2.8 mm and $29.7^\circ \pm 10.5^\circ$, respectively, which were 21.8 ± 3.4 mm and $16.2^\circ \pm 8.4^\circ$ after the operation, respectively. No significant changes of the posterior vertebral height before and after the operation were observed. The JOA score before the

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operation and at the last follow-up was 9.46 ± 2.58 and 21.52 ± 3.55 , respectively, and the difference was significant ($P < 0.05$). During the whole period of follow-up, no re-loss of vertebral height, aggravation of kyphosis, and recurrence of nerve symptoms of the affected limbs were observed. Postoperatively, 6 of 8 subscales measured by SF-36 were significantly improved. One patient had the complication of cement leakage after the operation, but with no clinical symptom.

Conclusion PKP with discectomy and PLF is effective and relatively safe for the treatment of OVCFs combined with LDD, which can relieve the back pain and nerve symptoms of the affected limbs, allow patients to do exercises off the bed at the early stage, and reduce the complication in the bed.

Key words: Osteoporotic vertebral compression fractures; Lumbar degenerative diseases; Percutaneous kyphoplasty; Posterolateral fusion

骨质疏松 (Osteoporosis OP) 是一种以低骨量和骨组织微结构破坏为特征, 导致脆性增加的全身性疾病, 这种低骨量和微结构破坏在脊柱中表现较早、较广泛, 常导致椎体形态、脊柱曲度和力学程度的改变, 其中以下腰段脊柱改变较为明显, 其引发的脊柱变形和腰背部疼痛, 如老年性腰椎间盘突出, 继发性腰椎管狭窄症的发病率越来越高, 脊椎退变伴发骨质疏松逐年增加^[1]。骨质疏松性椎体压缩骨折 (Osteoporotic vertebral compression fractures OVCFs) 主要发生于年龄较大的患者, 而这一年龄段恰是脊柱退变的高发期, 一旦发生 OVCFs 同时合并腰椎退变性疾病 (lumbar degenerative diseases, LDD), 其治疗是比较棘手的, 采用何种术式治疗能使患者早期下地、功能锻炼及预防椎体再次骨折显得尤为重要, 本文旨在通过采用一期后路腰椎间盘切除、椎体后外侧融合 (Posterolateral fusion PLF) + 伤椎椎体后凸成形术 (Percutaneous kyphoplasty, PKP) 治疗 OVCFs 合并 LDD, 并评价 PKP + PLF 术式的有效性 & 安全性。现就 2007 年 5 月至 2009 年 6 月间, 12 例 OVCFs 合并不同程度 LDD 的患者的手术方式及临床疗效进行分析, 报道如下:

1 资料与方法

1.1 一般资料

本组 12 例 (14 椎) OVCFs 患者完成 PKP 手术, 12 例患者同时患不同程度 LDD, 依术前病情而行单节段或多节段 PLF 术; 其中男 5 例, 女 7 例; 年龄 54 ~ 79 岁, 平均 64.9 岁。单椎体骨折 9 例, 双椎体骨折 1 例, 三椎体骨折 1 例, 5 椎体骨折 1 例; 累及节段, T6 1 椎, T11 1 椎, T12 7 椎, L1 6 椎, L2 2 椎, L3 1 椎, L4 1 椎; 其中并退行性滑脱 2 例; 并腰椎管狭窄症 5 例; 并腰椎间盘突出症 (Lumbar disc herniation LDH) 5 例; 其中 1 例为 PKP 术后再骨折, 1 例有三个椎体陈旧性骨折、左髌骨性关节炎并左桡骨远端陈旧性骨折史。12 例均符合原发性骨质疏松方数据

疏松症诊断标准 (T 值 ≤ -2.5)。致伤原因主要为跌伤或轻微外力作用, 伤后因腰背痛而就诊。入院后通过患者主诉结合查体以及影像学检查, 最终确诊 12 例合并不同程度 LDD。

1.2 患者纳入或排除标准

12 例患者均符合 OP 的诊断标准^[2] (T 值 ≤ -2.5); 所有患者患 LDH 或腰椎管狭窄症或退变性滑脱等疾病均经正规保守治疗三个月以上, 症状、体征改善不明显, 严重影响生活质量, 并在治疗期间并发 OVCFs 且要求手术治疗; 所有患者骨折椎体均无椎管内明显骨块占位和神经损伤表现; 患者患肢神经症状皆有腰椎退变疾病 (LDH、椎管狭窄、退变性滑脱) 所引起, 可与椎体骨折所引发的症状相鉴别; MRI 检查确认骨折椎 T1 加权像低信号, T2 加权像和脂肪抑制像高信号, 均为新鲜骨折, 即“责任椎”; 所有手术椎压缩程度评价, 采用 Genant^[3] 半定量法, 均为 III 级。

1.3 手术方法

采用静吸复合麻醉, 俯卧位, 取后正中切口入路, 依据术前检查结合患者症状、体征, 先行 PLF 术。术毕根据术前检查确认的骨折“责任椎”后, 采用美国 Kyphon 公司提供的微创器械和球囊, T10 以上节段选择经椎弓根旁途径置入球囊, T10 以下节段选择经椎弓根途径置入球囊, 每步操作均在“C”型臂 X 线机监视下完成^[4]。本组 12 例均经双侧穿刺球囊成形完成手术。术后仰卧 2 h, 常规应用抗生素预防感染, 术后置负压引流 48 h, 引流量 $< 50\text{ml}$ 后拔除引流管。嘱患者床上行腰背肌及双下肢主动功能锻炼, 2 周后支具保护下地活动。针对患者具体病情予以全身抗骨质疏松综合治疗, 以预防二次骨折的发生。

2 结果

本组 12 例患者手术时间 (PKP + PLF) 140 ~ 210 min, 平均 170 min。每一椎体注射骨水泥 3.5 ~ 6.5

ml, 平均 5.3 ml。所有患者均术后 2 周内出院。术后随访 12~36 个月, 平均 25 个月。

2.1 骨折椎高度和后凸角度的变化

术前、术后和末次随访时骨折椎高度变化见表 1, 所有患者均为不同时期椎体前缘、中部、后缘高度的自身比较。统计结果显示手术前后椎体前缘、中部高度差异有统计学意义 ($P < 0.05$), 后缘高度变化无统计学意义 ($P > 0.05$); 末次随访与手术后相比, 椎体前缘、中部和后缘高度均无统计学意义 ($P > 0.05$)。

骨折椎后凸角由椎体前上缘、后上缘连线与前下缘、后下缘连线相交所得。本组患者术前骨折椎后凸角平均为 $29.7^\circ \pm 10.5^\circ$ ($13.6^\circ \sim 45.3^\circ$), 术后为 $16.2^\circ \pm 8.4^\circ$ ($3.4^\circ \sim 35.8^\circ$), 平均矫正 $10.5^\circ \pm 6.8^\circ$, 手术前后差异有统计学意义 ($P < 0.05$)。末次随访为 $22.4^\circ \pm 9.5^\circ$ ($2.6^\circ \sim 35.1^\circ$), 与术后相比无统计学意义。

2.2 术后功能变化

12 例患者的疼痛症状得到明显缓解, 术前 JOA 疼痛评分平均为 (8.15 ± 2.73) 分, 术后为 (21.46 ± 6.84) 分, 手术前后差异有统计学意义 ($P < 0.05$), 末次随访为 (20.38 ± 6.36) 分, 与术后相比差异无

统计学意义。SF-36 健康调查评分^[5]包括 8 个分项目度: 机体机能 (physical function, PF)、独立功能 (role function, RF)、躯体疼痛 (bodily pain, BP)、全身情况 (general health, GH)、活力 (vitality, VT)、社会功能 (social function, SF)、情感 (role emotion, RE) 和精神状态 (mental health, MH)。患者得分情况见表 3, 除全身情况和社会功能两项, 其余 6 项手术后均有显著提高。

表 1 椎体高度变化 ($\bar{x} \pm s$, $n = 14$, cm)

Table 1 The changes of the vertebral height ($\bar{x} \pm s$, $n = 14$ cm)

部位	术前	术后 3 个月	末次随访
前缘	1.6 ± 0.4	2.5 ± 0.5^a	2.4 ± 0.6^b
中部	1.7 ± 0.5	2.4 ± 0.6^a	2.3 ± 0.7^b
后缘	2.5 ± 0.6	2.7 ± 0.7^a	2.6 ± 0.5^b

注: ^a 与术前比较: $P < 0.05$; ^b 与 ^a 比较: $P > 0.05$

表 2 JOA 评分及 Cobb 手术前后变化

Table 2 The scores of JOA and the changes of Cobb angle before and after the operation.

项目	术前	术后 3 个月	末次随访	改善率
JOA	8.15 ± 2.73	21.46 ± 6.84^a	20.38 ± 6.36^b	78.4%
Cobb	$29.7^\circ \pm 10.5^\circ$	$16.2^\circ \pm 8.4^\circ^a$	$22.4^\circ \pm 9.5^\circ^b$	—

注: ^a 与术前比较: $P < 0.05$; ^b 与 ^a 比较: $P > 0.05$

表 3 患者手术前后 SF-36 健康调查评分

Table 3 The scores of patients measured using SF-36 health investigation questionnaire before and after the operation

项目	PF	RF	BP	GH	VT	SF	RE	MH
术前	30.1 ± 13.2	14.4 ± 12.2	20.6 ± 12.1	43.7 ± 18.2	23.4 ± 6.2	32.5 ± 10.3	40.7 ± 15.4	47.4 ± 17.5
术后 3 个月	45.2 ± 16.4^a	32.5 ± 9.8^a	44.3 ± 14.1^a	48.2 ± 13.4	47.2 ± 12.3^a	36.7 ± 11.5	52.8 ± 15.2^a	69.8 ± 15.8^a
末次随访	44.9 ± 14.5^b	33.9 ± 11.6^b	45.9 ± 15.6^b	52.3 ± 16.3	48.3 ± 9.5^b	34.2 ± 11.0	56.3 ± 11.4^b	68.2 ± 12.4^b

注: ^a 与术前比较: $P < 0.05$; ^b 与 ^a 比较: $P > 0.05$

2.3 并发症

本组 12 例患者均顺利完成手术, 无术中死亡。1 例患者出现骨水泥渗漏, 未出现临床症状。随访中 1 例患者出现其他椎体骨折, 再次行 PKP 术治疗。

2.4 统计学处理

所得数据用均数 $\pm$ 标准差表示, 采用 SPSS 13.0 统计软件对数据进行处理, JOA 评分及 SF-36 健康调查评分所有数据进行重复测量方差分析, 总体差异有统计学意义, 组间比较采用 LSD 检验, 设 $P < 0.05$ 为差异有显著性。

3 讨论

目前有关 OVCFs 合并 LDD 同时行手术治疗的

报道较少, PKP 治疗 OVCFs 近年来广泛开展, 该手术缓解疼痛快, 能恢复椎体高度, 矫正后凸畸形, 改善老年患者的生活质量。PLF 是经典治疗腰痛常用的脊柱手术之一, 它通过在去皮质的横突间、关节突关节进行植骨完成 PLF, 从而实现病变节段的稳定, 明显提高了融合率, 最高可达到 96%^[6]。但对于该术式的选择, 有其严格的指征: 如严重骨质疏松 ($T < -2.5$); 多节段退变 (>3 个) 等。因此, 本研究回顾性分析我院行 PKP + PLF 术的患者中资料完整且至少随访 1 年以上的 12 例 OVCFs 并 LDD 的患者, 发现术后止痛效果满意, 具有一定的恢复椎体高度和矫正后凸畸形、明显改善患者腰背痛及患肢神经症状的能力, 患者可早期下地活动、功能锻炼, 减少了长期卧床的并发症。

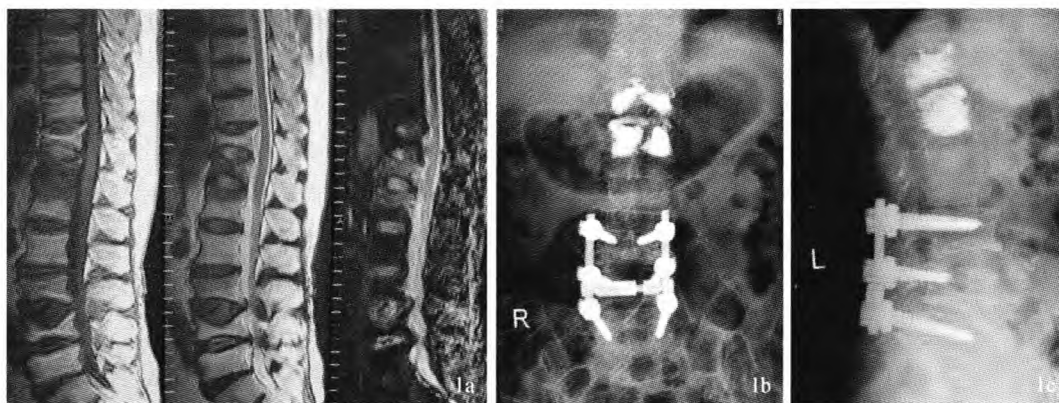


图1 a术前MRI T1示T12、L1低信号,T2、STIR示T12、L1高信号(新鲜骨折,责任椎),L3~4,L4~5椎间盘突出,压迫硬膜囊,脊髓明显受压,T11、L3、L4陈旧性骨折;b、c术后X正侧位片示T12、L1骨水泥弥散良好,后壁无骨水泥渗漏,椎体较术前明显复位,L3~4,L4~5减压充分,椎弓根螺钉位置佳

Fig.1 MRI image of T1 showing low signal of L1, STIR showing high signal of T12 and L1 (fresh fracture, responsible vertebrae), disc protrusion between L3-4 and L4-5, compression of the spinal cord, and past fractures of T11, L3, and L4 (a); X-ray image showing good distribution of bone cement in T12 and L1, no leakage of bone cement in posterior wall, obvious relocation of the vertebral body, full depression of L3-4 and L4-5, and good location of the screw (b, c)

3.1 OP与OVCFs及LDD的关系

研究证实腰椎退变的程度伴随着骨质疏松的升级而加重^[1],由于OP所致每个椎体骨小梁减少,从而使得骨的强度减弱,脆性增加,易于骨折;其次其力学稳定性能差,将导致椎间盘从膨出到脱出的病理性改变,造成根袖处水肿、渗出等炎性反应,引起下腰痛伴下肢放射痛,间歇性跛行等相应的神经受压症状,所以说OP是导致OVCFs及LDD的重要因素之一;Zhang^[7]等研究表明在增龄过程中,骨密度和椎间盘退变呈正相关,骨质疏松和椎间盘退变呈负相关。尤以椎体骨密度和椎间盘退变相关性最强,这些结果与人类的流行病学研究相一致^[8],但这与椎间盘退变时椎体较易发生骨折并不矛盾^[9]。

3.2 OVCFs并LDD手术的必要性

Hallberg^[10]和Johnell等^[11]研究显示OVCFs采用保守治疗难以获得令人满意的效果,5年内的死亡率甚至高于髌部骨折。有研究显示除骨折疼痛引起的一系列不良反应外,呼吸、循环系统也会受到影响^[4]。Schlaich^[12]等发现胸椎压缩骨折后后凸增大将明显影响肺功能,且与骨折压缩程度和后凸角度呈显著相关性。Yang^[13]等报告胸椎压缩性骨折PKP术后,用力肺活量和最大通气量迅速得到改善,且后者在术后相当长的时间内还会进一步增加。鉴于患LDD的老年患者均有不同程度的骨质疏松,平素行动不便,机体反应差,易跌倒或受伤致椎体及髌部骨折,因此我们建议中老年患者(>50岁)患LDD

(LDH、腰椎管狭窄症、退变性腰椎滑脱)经过正规保守治疗三个月以上,症状、体征改善不明显,严重影响生活质量且在治疗期间同时并发OVCFs,在全身情况允许的情况下应积极一期行PKP+PLF手术治疗,可有效的缓解疼痛,一定程度上恢复椎体高度、矫正后凸畸形,明显减少术后长期卧床的并发症,达到早期行肌肉主被动功能锻炼、预防继发性骨质疏松、阻断椎体再次骨折的恶性循环,提高生活质量的目的。

3.3 OVCFs并LDD的手术方式

中老年胸腰椎骨折的治疗,一般应遵循复位、固定、功能锻炼的基本原则,但在具体方法上应有所选择。随着社会老龄化,OVCFs的发生率逐年上升。长期以来,对OVCFs治疗,除卧床休息、支具、对症镇痛治疗外,缺乏积极的处理方法。许多患者生活质量下降,形成恶性循环,甚至导致死亡^[3]。而OVCFs并LDD的治疗对于我们来说无疑更是一种挑战,是一期还是分期手术治疗尚存在不同观点,但随着麻醉技术和手术经验的丰富以及围手术期管理和监护水平的提高,通过一期PKP+PLF手术治疗OVCFs并LDD成为可能,分期手术无疑增加了患者术中再出血、再住院时间、二次手术创伤并增加了治疗费用及术后并发症,这与我们的治疗原则是相违背的。众所周知,PKP因创伤小、止痛效果好、并发症少等优点近年来成为治疗OVCFs的主要方法^[14-16]。而对于LDH、椎管狭窄、退变性滑脱等疾

病的手术治疗是采用 PLF, 还是采用后路腰椎椎体间融合术 (Posterior lumbar interbody fusion PLIF), 鉴于有严重骨质疏松 ($T < -2.5$) 患者行 PLIF, 术后有移植物沉陷进入椎体内的报道^[17]。因此我们认为行 PLF 是比较合适的选择^[18]。而对于椎体周壁破裂的 OVCFs, 由于骨水泥容易渗漏而使手术风险增大, 尤其是椎体后壁破裂者被国内外一些学者列为手术禁忌证^[19]。我们对这种特殊病例在行 PKP 治疗灌注骨水泥时, 以全程动态“C”型臂 X 线机监测, 当骨水泥接近椎体边缘或后壁时立即停止, 此时不得以高压和高灌注量追求骨水泥的充分扩散, 适可而止, 术中可用少量团状中晚期骨水泥先行灌注以堵塞缺损, 避免骨水泥自缺损处渗漏, 待其凝固后再以团状早期骨水泥进行灌注。采用个体化灌注骨水泥方法, 本组 3 例椎体后壁有损伤的患者均顺利完成手术, 未出现症状性骨水泥渗漏等并发症, 随访疗效满意。我科 12 例患者在术前充分评估全身状况的前提下二期行 PLF + PKP, 取得了满意的效果。

3.4 PKP 及 PLF 术的治疗效果

本组的随访结果显示 PKP 对于 OVCFs 具有较好的椎体复位和矫正后凸畸形的能力, 且能在术后相当长的时间内维持复位作用。Garfin 等^[20]的多中心前瞻性研究报告显示 155 例 214 椎应用 PKP 术后骨折椎高度和后凸畸形均明显改善, 经 2 年以上随访, 矫正度无明显丢失, 与本组随访结果相似。Ledlie 等^[21]比较了 117 例 151 椎 PKP 术后 1 年和 2 年时的影像学资料, 发现矫正度得到很好地维持。然而我们认为正确评估 PKP 对骨折椎的复位和矫正效果仍有待深入研究, 国内尚缺乏骨折椎术中体位复位作用的统计, 另外椎体两侧不对称压缩也可能影响测量结果。本组研究骨折椎后凸角由术前平均 $29.7^\circ \pm 10.5^\circ$ 降低至术后 $16.2^\circ \pm 8.4^\circ$, 平均矫正 $10.5^\circ \pm 6.8^\circ$, JOA 疼痛评分由术前平均 (8.15 ± 2.73) 分, 上升为术后 (21.46 ± 6.84) 分, SF-36 健康调查评分除全身情况和社会功能两项, 其余 6 项手术后均有显著提高, 手术前后差异有统计学意义 ($P < 0.05$)。

综上, 从本组的随访结果看, 所有患者腰背痛及患肢神经症状明显缓解, 虽有 1 例发生骨水泥渗漏, 但无严重并发症, 说明 PKP + PLF 是治疗中老年 OVCFs 并 LDD 的有效方法。但本文存在的不足之处: 首先是本组病例数较少, 近期随访效果满意, 远期效果尚需大样本、长期的随访; 其次是没有设置分期手术的病例对照, 随着今后病例数的增加, 我们可

完成对照研究。

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