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PKP 治疗骨质疏松性椎体压缩骨折的预后评价及继发危险因素分析*

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摘要 目的:分析椎弓根入路行椎体后凸成形术(PKP)治疗骨质疏松性椎体压缩骨折的预后评价及继发危险因素分析。**方法:**选择2016年2月-2018年2月我院收治的骨质疏松性椎体压缩骨折患者85例纳入本次研究,采用随机数表法分为观察组(n=43)和对照组(n=42)。对照组使用经皮椎体成形术进行治疗,观察组采用PKP进行治疗。比较两组患者手术情况、术后情况、椎体前缘高度丢失率、Cobb角、继发性骨折发生情况及分析骨质疏松性椎体压缩骨折患者术后继发骨折的危险因素。**结果:**观察组手术时间、透视次数、骨水泥注入量、术中出血量均显著低于对照组,差异显著($P<0.05$);观察组疼痛缓解时间、下地时间及住院时间均显著低于对照组,差异显著($P<0.05$);治疗前,两组椎体前缘高度丢失率、Cobb角比较,无显著差异;治疗后,两组患者的椎体高度丢失率明显下降,但两组术后7d、术后6月两组椎体前缘高度丢失率、Cobb角比较无显著差异;观察组术后12月椎体前缘高度丢失率、Cobb角低于对照组,差异显著($P<0.05$);所有患者均随访12月,其中22例(25.88%)发生继发性椎体骨折,进行单因素分析,结果发现,两组患者性别、骨折部位、局部矢状面后凸角度、骨水泥量、椎体高度恢复、术后抗骨质疏松治疗差异无统计学意义($P>0.05$);骨质疏松原因、骨水泥椎间隙渗漏、术后支具佩戴、原发骨折类型与骨质疏松性椎体压缩骨折患者术后发生继发骨折相关($P<0.05$)。多因素 Logistic 分析显示,骨质疏松原因、骨水泥椎间隙渗漏、术后支具佩戴、原发骨折类型均是骨质疏松性椎体压缩骨折患者术后发生继发骨折的独立危险因素($P<0.05$)。**结论:**在骨质疏松性椎体压缩骨折患者中应用PKP可有效改善手术情况,随着时间的延长,PKP更有利于维持患者椎体高度;骨质疏松原因、骨水泥椎间隙渗漏、术后支具佩戴、原发骨折类型是骨质疏松性椎体压缩骨折患者术后发生继发骨折的危险因素,临床上对于具有危险因素的患者引起重视,并采取干预措施。

关键词:椎弓根入路行椎体后凸成形术;骨质疏松;椎体压缩骨折;预后评价;继发;危险因素

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Prognostic Evaluation and Secondary Risk Factors Analysis of Osteoporotic Vertebral Compression Fracture Treated by PKP*

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ABSTRACT Objective: To study prognostic evaluation and secondary risk factors analysis of osteoporotic vertebral compression fracture treated by transpedicular approach for kyphoplasty (PKP). **Methods:** 85 patients with osteoporotic vertebral compression fracture admitted to our hospital from February 2016 to February 2018 were selected to be included in this study and randomly divided into the observation group (n=43) and the control group (n=42). The control group was treated with percutaneous vertebroplasty and the observation group was treated with PKP. The operation situation, postoperative status, anterior vertebral height loss rate, Cobb Angle and postoperative secondary fractures were compared between the two groups. The risk factors of postoperative secondary fractures in patients with osteoporotic vertebral compression fracture were analyzed. **Results:** The operative time, number of fluoroscopy, amount of bone cement injection and intraoperative blood loss in the observation group were significantly lower than those in the control group, with significant differences ($P<0.05$). The time of pain relief, time on the ground and length of hospital stay in the observation group were significantly lower than those in the control group, with significant differences ($P<0.05$). Before treatment, there was no significant difference in the loss rate and Cobb Angle of anterior vertebral edge height between the two groups. After treatment, the loss rate of vertebral body height in the two groups decreased significantly, but there was no significant difference in the loss rate of vertebral anterior margin height and Cobb Angle between the two groups 7 days after surgery and 6 months after surgery. The anterior vertebral height loss rate and Cobb Angle of the observation group were lower than those of the control group 12 months after surgery, with significant differences ($P<0.05$). All the patients were followed up for 12 months, and 22 (25.88%) of them had secondary vertebral fractures. Uni-factor analysis showed that there was no statistically significant difference between the two groups in gender, fracture site, local

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sagittal kyphosis angle, bone cement volume, vertebral height recovery, and postoperative anti-osteoporosis treatment ($P>0.05$). The causes of osteoporosis, bone cement intervertebral space leakage, postoperative brace wearing, and primary fracture type were correlated with postoperative secondary fractures in patients with osteoporotic vertebral compression fracture ($P<0.05$). Multivariate Logistic analysis showed that the causes of osteoporosis, bone cement intervertebral space leakage, postoperative brace wearing and primary fracture type were all independent risk factors for postoperative secondary fractures in patients with osteoporotic vertebral compression fracture ($P<0.05$). **Conclusion:** In patients with osteoporotic vertebral compression fractures in the application of PKP can effectively improve the operation situation, with the extension of time, the PKP holds more conducive to maintaining vertebral body height; in patients with osteoporotic vertebral compression fractures of postoperative secondary fracture, osteoporosis causes, intervertebral bone cement leakage, postoperative brace wearing, and primary fracture type are risk factors; clinical for patients with these risk factors should be taken seriously, and intervention measures should be taken.

Key words: Vertebral kyphoplasty was performed by pedicle approach; Osteoporosis; Vertebral compression fracture; Prognosis valuation; Secondary; Risk factors

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前言

骨质疏松是系统性骨病,容易使椎体产生压缩骨折,通常指前屈伤力导致椎体前部压缩,近年来随着人群平均年龄的增加其发病率呈上升趋势,已成为老年群体较为常见的疾病,临床表现为持久性疼痛,其中约30%患者还伴有顽固性慢性疼痛,部分患者还会出现脊柱后凸畸形等,丧失部分生理功能,影响其生活质量^[1,2]。该病传统治疗方案以保守治疗为主,仅为对症处理与卧床休息,但是病程往往较长,长时间卧床容易引起压疮、坠积性肺炎、深静脉血栓等多种并发症,影响患者预后^[3]。目前,对于骨质疏松性椎体压缩骨折多采用微创技术治疗,其中经椎弓根椎体后凸成形术(PKP)为最常见的,具有创伤小、效果显著的优势^[4,5]。PKP主要是通过通过对后凸椎体进行扩张、骨水泥灌注,使骨折得到最大程度复位,稳定了骨折,恢复椎体力学强度,有效缓解了患者疼痛程度^[6]。但有文献显示,在PKP治疗后部分患者会发生其他椎体继发骨折^[7]。本研究旨在探讨PKP治疗骨质疏松性椎体压缩骨折的预后评价,并对继发骨折的危险因素进行分析,现报道如下。

1 资料与方法

1.1 一般资料

选择2016年2月-2018年2月我院收治的骨质疏松性椎体压缩骨折患者85例纳入本次研究,采用随机数表法分为2组,观察组43例,其中男29例,女14例;年龄52~75岁,平均(66.32±4.56)岁,其中骨折部位:第1腰椎13例,第2腰椎8例,第3腰椎9例,第11胸椎6例,第12胸椎7例。对照组42例,其中男26例,女16例,年龄51~73岁,平均(66.36±4.62)岁,其中骨折部位:第1腰椎15例,第2腰椎6例,第3腰椎8例,第11胸椎5例,第12胸椎8例。两组基线资料无显著差异($P>0.05$),存在可比性。

参照《骨质疏松性椎体压缩性骨折的治疗指南》^[8],(1)腰背部疼痛;(2)骨密度检查确诊;(3)CT检查证实。

纳入标准:(1)符合上述诊断标准;(2)无严重内科疾病;(3)创伤后及时入院进行治疗;(4)签署知情同意书。排除标准:(1)合并出血性疾病者;(2)严重慢性病患者;(3)免疫性疾病

者;(4)肿瘤等导致的病理性骨折;(5)药物、酒精滥用史;(6)合并椎体结核者;(7)病例资料不全者。

1.2 方法

对照组患者取俯卧位,X线机透视定位病椎,投影点外上缘2mm进行穿刺,透视下沿椎弓根外上缘进针,进针过程注意观察,穿刺后沿导针插入工作套管,将骨水泥缓慢注入椎体,在连续透视下通过椎体中线。当发现骨水泥疑似渗漏时,应停止注射。骨水泥固化后,拔出工作通道,覆盖无菌敷料。

观察组建立直径约为4.5mm的中空工作通道,将特制扩张球囊通过工作通道置入椎体后,连通高压注射器,将未膨胀的球囊插入椎体前中部,注射造影剂使球囊缓慢膨胀。透视显示球囊扩张良好。准备骨水泥,当骨水泥达到“拉丝阶段”时,抽出造影剂并取出气囊,骨水泥注入与对照组一致。

采用自制调查问卷收集患者临床资料,包括性别、骨折部位、局部矢状面后凸角度、骨水泥量、椎体高度恢复、术后抗骨质疏松治疗、骨质疏松原因、骨水泥椎间隙渗漏、术后支具佩戴、原发骨折类型等。采用单因素及多因素Logistic回归分析骨质疏松性椎体压缩骨折患者术后发生继发骨折的危险因素。

1.3 观察指标

记录两组患者的临床疗效、手术情况、骨水泥灌注量、Cobb角、椎体前缘高度丢失率及骨水泥渗漏率。

1.4 统计学分析

以spss18.0软件包处理,计量资料用均数±标准差($\bar{x}\pm s$)表示,组间比较使用独立样本t检验,计数资料以率表示, χ^2 检验,多因素分析采用非条件Logistic回归分析, $P<0.05$ 差异具有统计学意义。

2 结果

2.1 两组手术情况比较

观察组手术时间、透视次数、骨水泥注入量、术中出血量均显著低于对照组,差异显著($P<0.05$),见表1。

2.2 两组术后情况比较

观察组疼痛缓解时间、下地时间及住院时间均显著低于对照组,差异显著($P<0.05$),见表2。

2.3 两组椎体前缘高度丢失率和Cobb角比较

治疗前,两组椎体前缘高度丢失率、Cobb 角比较,无显著差异;治疗后,两组患者的椎体高度丢失率明显下降,但两组术后 7 天、术后 6 月两组椎体前缘高度丢失率、Cobb 角比较无显

著差异;观察组术后 12 月椎体前缘高度丢失率、Cobb 角低于对照组,差异显著($P<0.05$),见表 3。

表 1 两组手术情况比较($\bar{x}\pm s$)
Table 1 Comparison between the two groups($\bar{x}\pm s$)

| Groups | n | Operative time(min) | Times of fluoroscopy (second) | Injection volume of bone cement(mL) | Intraoperative hemorrhage(mL) |
|-------------------|----|---------------------|-------------------------------|-------------------------------------|-------------------------------|
| Observation group | 43 | 33.59±6.72 | 20.21±2.79 | 3.61±1.21 | 6.21±1.54 |
| Control group | 42 | 41.79±9.13 | 26.34±2.58 | 4.97±2.16 | 7.09±1.78 |
| t value | | 4.724 | 10.511 | 3.592 | 2.439 |
| P value | | 0.000 | 0.000 | 0.001 | 0.017 |

表 2 两组术后情况比较($\bar{x}\pm s, d$)
Table 2 Comparison between the two groups($\bar{x}\pm s, d$)

| Groups | n | Pain relief time | Down time | Length of stay |
|-------------------|----|------------------|-----------|----------------|
| Observation group | 43 | 2.45±1.13 | 2.14±0.36 | 11.45±5.41 |
| Control group | 42 | 6.38±1.05 | 3.42±0.59 | 16.59±4.27 |
| t value | | 16.601 | 12.106 | 4.855 |
| P value | | 0.000 | 0.000 | 0.000 |

表 3 两组椎体前缘高度丢失率和 Cobb 角比较($\bar{x}\pm s$)
Table 3 Comparison of vertebral height loss rate and Cobb angle between the two groups($\bar{x}\pm s$)

| Groups | n | Loss rate of anterior height of vertebral body(%) | | | |
|-------------------|----|---|------------------|------------------|-------------------|
| | | Preoperative | Postoperative 7d | Postoperative 6m | Postoperative 12m |
| Observation group | 43 | 38.64±1.24 | 10.51±2.47 | 13.78±3.41 | 14.31±4.24 |
| Control group | 42 | 38.57±1.31 | 11.35±3.21 | 14.65±2.78 | 16.79±4.13 |
| t value | | 0.253 | 1.354 | 1.287 | 2.731 |
| P value | | 0.801 | 0.179 | 0.202 | 0.008 |

| Groups | n | Cobb angle(°) | | | |
|-------------------|---|---------------|------------------|------------------|-------------------|
| | | Preoperative | Postoperative 7d | Postoperative 6m | Postoperative 12m |
| Observation group | | 27.59±2.21 | 10.78±2.45 | 11.36±2.61 | 12.36±2.14 |
| Control group | | 27.63±2.25 | 11.69±2.12 | 12.15±2.34 | 14.59±1.98 |
| t value | | 0.083 | 1.829 | 1.468 | 4.984 |
| P value | | 0.934 | 0.071 | 0.146 | 0.000 |

2.4 两组单因素分析

所有患者均随访 12 月,其中 22 例(25.88%)发生继发性椎体骨折,进行单因素分析,结果发现,两组患者性别、骨折部位、局部矢状面后凸角度、骨水泥量、椎体高度恢复、术后抗骨质疏松治疗差异无统计学意义($P>0.05$);骨质疏松原因、骨水泥椎间隙渗漏、术后支具佩戴、原发骨折类型与骨质疏松性椎体压缩骨折患者术后发生继发骨折相关($P<0.05$)见表 4。

2.5 骨质疏松性椎体压缩骨折患者术后发生继发骨折的危险因素 Logistic 分析

将以上有统计学意义的因素作为自变量,以骨质疏松性椎体压缩骨折患者术后发生继发骨折为因变量,进行多因素非条

件 Logistic 分析。多因素 Logistic 分析显示,骨质疏松原因、骨水泥椎间隙渗漏、术后支具佩戴、原发骨折类型均是骨质疏松性椎体压缩骨折患者术后发生继发骨折的独立危险因素($P<0.05$)。见表 5。

3 讨论

骨质疏松是以矿物质进行性减少和骨密度逐渐降低为特征的退化性疾病,多发于老年人和绝经期妇女,多表现为骨弹性降低及脆性增加,近年来随着我国人口老龄化的加剧,其发病率呈上升趋势^[9-11]。椎体压缩性骨折是骨质疏松症的主要并发症之一,患者多伴有强烈局部疼痛感,严重者可发生脊髓压

表 4 两组单因素分析[n(%)]
Table 4 Single factor analysis of two groups[n(%)]

| Factor | | Secondary fracture(n=22) | Not secondary(n=63) | χ^2 value | P value |
|---|-------------------|--------------------------|---------------------|----------------|---------|
| Gender | Male | 14(63.64) | 42(66.67) | 0.067 | 0.796 |
| | Female | 8(36.36) | 21(33.33) | | |
| Causes of osteoporosis | Primary | 18(81.82) | 28(44.44) | 9.173 | 0.002 |
| | Secondary | 4(18.18) | 35(55.56) | | |
| Fracture site | Thoracolumbar | 7(31.82) | 25(39.68) | 0.450 | 0.798 |
| | Thoracic vertebra | 9(40.91) | 22(34.92) | | |
| | Lumbar vertebra | 6(27.27) | 16(25.40) | | |
| Local sagittal kyphosis angle | <20° | 6(27.27) | 19(30.16) | 0.065 | 0.798 |
| | ≥ 20° | 16(72.73) | 44(69.84) | | |
| Bone cement volume | < 5 mL | 5(22.73) | 23(36.51) | 1.402 | 0.236 |
| | ≥ 5 mL | 17(77.27) | 40(63.49) | | |
| Leakage of bone cement intervertebral space | Yes | 17(77.27) | 26(41.27) | 8.456 | 0.004 |
| | Nothing | 5(22.73) | 37(58.73) | | |
| Recovery of vertebral height | < 50% | 8(36.36) | 27(42.86) | 0.284 | 0.594 |
| | ≥ 50% | 14(63.64) | 36(57.14) | | |
| Postoperative brace wearing | Yes | 2(9.09) | 31(49.21) | 11.048 | 0.001 |
| | Nothing | 20(90.91) | 32(49.21) | | |
| Anti osteoporosis treatment after operation | Yes | 11(50.00) | 33(52.38) | 0.037 | 0.847 |
| | Nothing | 11(50.00) | 30(47.62) | | |
| Primary fracture type | Fresh | 19(86.36) | 35(55.56) | 6.679 | 0.009 |
| | Obsolete | 3(13.64) | 28(44.44) | | |

表 5 骨质疏松性椎体压缩骨折患者术后发生继发骨折的危险因素 Logistic 分析

Table 5 logistic analysis of risk factors of secondary fracture in patients with osteoporotic vertebral compression fracture after operation

| Factor | β | SE | Wald | df | OR | P |
|---|---------|-------|-------|----|-------|--------|
| Causes of osteoporosis | 1.115 | 0.385 | 5.263 | 1 | 3.521 | 0.005 |
| Leakage of bone cement intervertebral space | 1.236 | 0.446 | 4.523 | 1 | 4.136 | 0.004 |
| Postoperative brace wearing | 2.156 | 0.257 | 6.125 | 1 | 3.596 | 0.016 |
| Primary fracture type | 1.529 | 0.361 | 7.693 | 1 | 2.547 | 0.0001 |

迫,导致活动受限,严重影响患者的运动功能及生活质量^[12-15]。临床常采用手术治疗,其中 PKP 是最有效的术方法,PKP 是经过经皮穿刺至骨折椎体,在塌陷椎体内注入骨水泥,能增强椎体强度,扩张伤椎恢复塌陷椎体的高度,重建脊柱生物机械强度、减轻患者疼痛感^[16-19]。

本研究结果显示,使用 PKP 治疗的患者手术时间、透视次数、骨水泥注入量、术中出血量均显著低于对照组,且疼痛缓解时间、下地时间及住院时间均显著低于对照组,结果提示,PKP 治疗骨质疏松性椎体压缩骨折效果显著,可减少手术时间及住院时间。Zhang Y^[20]等研究也显示,PKP 在骨质疏松性椎体压缩骨折的治疗中效果显著。分析其原因可能是因为经皮椎体成形

术时仅将病变椎体固定于畸形位置,并未对其实施骨折复位,难以恢复椎体高度;而 PKP 是在经皮椎体成形术的基础上改良的手术方式,其通过气囊扩张复位骨折椎体,在椎体内部形成空间后再进行骨水泥灌注,减小灌注骨水泥所需推力,故其手术效果高于对照组。本研究结果还显示,两组患者椎体高度丢失率明显下降,且使用 PKP 治疗的患者术后 12 月椎体前缘高度丢失率、Cobb 角低于对照组,结果提示,采用 PKP 治疗骨质疏松性椎体压缩骨折效果显著,恢复其骨折椎体高度,改善机体功能。分析其原因可能是因为 PKP 能最大程度恢复塌陷椎体高度,重构椎体解剖结构,改善后凸畸形,恢复患者机体功能。

随着临床的深入研究,有文献报道,在 PKP 后部分患者会

继发性椎体骨折^[21]。Takahashi S^[22]等研究对 38 例行 PKP 术后 8 个月患者进行随访,发现有 10 例(26.3%)患者继发椎体骨折。本研究结果显示,所有患者随访 12 个月,其中 22 例(25.88%)发生继发性椎体骨折,从生物力学角度分析其原因可能是因为 PKP 术在伤椎内注入骨水泥可导致局部生物力学特性短时间内发生改变,对相邻椎体的力学传导造成影响,从而增加再骨折的风险。因此明确骨质疏松性椎体压缩骨折后继发骨折的危险因素是预防再次骨折的关键。有研究显示,患者年龄增大患者体内性激素水平逐渐下降,导致机体抗氧化能力下降,而机体氧化应激状态时成骨细胞及功能受到抑制,增强破骨细胞的功能,从而导致骨质疏松^[23-25]。本研究中经多因素 Logistic 分析显示,骨质疏松原因、骨水泥椎间隙渗漏、术后支具佩戴、原发骨折类型均是骨质疏松性椎体压缩骨折患者发生术后发生继发骨折的独立危险因素。国外研究显示,PKP 术中向伤椎注入骨水泥,恢复椎体高度,增强椎体强度,而骨水泥分布不均,向椎间渗漏,使邻椎终板应力集中,增加再次骨折的风险,与本研究结果相似^[26-28]。分析其原因可能是因为骨密度是评估病人骨质疏松的重要原因,而低骨密度可使骨代谢处于负平衡,骨量丢失,骨质疏松程度加重,增加术后再次骨折的风险;骨水泥渗漏进入椎间盘内,影响椎间盘正常代谢,漏到椎间隙则能增加邻近节段终板的压力,加速椎间盘的退行性病变,降低椎间盘功能,进而容易引起再次骨折。还有研究显示,粥状期骨水泥注入是导致骨水泥渗漏的危险因素,骨水泥在稀薄期注入流动性大,更易流向阻力小的地方,故渗漏到椎体外的可能性更大^[29,30]。有学者提出,为减少骨水泥渗漏率,可选用高黏度的骨水泥^[31-33]。国外研究指出^[34],为减少 PKP 治疗骨质疏松性椎体压缩骨折后继发骨折的发生,有必要对患者进行干预,了解骨水泥椎间隙渗漏原因,减少骨水泥椎间隙渗漏的发生。Kristie N Tu^[35]等研究显示,随着年龄的增大,患者机体功能下降,容易发生摔倒等事件,增加骨折风险,因此,高龄是继发再次骨折的重要因素。但本研究中年龄不是继发骨折的危险因素,与 Kristie N Tu 等人存在差异,可能是由于选择的病例样本不一致,研究结果受样本影响,故后期将继续积累样本量,进一步深入研究。

综上所述,在骨质疏松性椎体压缩骨折患者中应用 PKP 可有效改善手术情况,随着时间的延长,PKP 更有利于维持患者椎体高度,骨质疏松原因、骨水泥椎间隙渗漏、术后支具佩戴、原发骨折类型是骨质疏松性椎体压缩骨折患者术后发生继发骨折的危险因素,临床上对于具有危险因素的患者引起重视,并采取干预措施。

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