

极外侧入路腰椎间融合术联合双侧椎弓根螺钉固定治疗腰椎滑脱症

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【摘要】目的:探讨极外侧入路腰椎间融合术(extreme lateral interbody fusion, XLIF)联合双侧椎弓根螺钉固定治疗腰椎滑脱症的临床及影像学疗效。**方法:**回顾性分析 2014 年 9 月~2016 年 8 月广州军区广州总医院采用 XLIF 联合双侧椎弓根螺钉固定治疗的单节段腰椎滑脱症患者的资料, 共 21 例, 其中女性 18 例, 男性 3 例; 年龄 57.0 ± 13.3 岁(45~77 岁), 随访时间 18.0 ± 5.0 个月(12~29 个月)。术前及末次随访时采用疼痛视觉模拟评分(visual analogue scale, VAS)及 Oswestry 功能障碍指数(Oswestry disability index, ODI)对临床疗效进行评估。术前及术后 3d 在轴位 MRI 上测量轴位椎管前后径(anterior-posterior diameter of the canal, APDC); 术前及末次随访时在侧位 X 线片测量椎间孔高度(foraminal height, FH)、椎间隙高度(disc height, DH), 并计算滑移百分比(slipping percentage, SP)。末次随访时应用 CT 评估融合率及融合器塌陷率。**结果:**术前及末次随访时腰痛 VAS 评分分别为 5.9 ± 1.7 分、 1.7 ± 0.7 分, 腿痛 VAS 评分分别为 6.1 ± 2.1 分、 1.4 ± 0.7 分, ODI 分别为 $(42.6 \pm 24.8)\%$ 、 $(12.1 \pm 4.2)\%$, 术前与末次随访比较差异均有统计学差异($P < 0.05$)。术前及术后 3d 的 APDC 分别为 11.2 ± 3.8 mm、 12.7 ± 4.0 mm, 差异具有统计学意义($P < 0.05$), 术前及末次随访手术节段 DH 分别为 7.2 ± 1.2 mm、 10.2 ± 1.4 mm, FH 分别为 17.3 ± 2.9 mm、 20.0 ± 1.7 mm, SP 分别为 $(16.4 \pm 7.0)\%$ 、 $(6.1 \pm 6.6)\%$, 术前与末次随访比较差异均有统计学意义($P < 0.05$)。术中无大血管损伤、腹腔脏器损伤、生殖股神经损伤等严重并发症, 术后 5 例患者出现大腿前方麻木, 症状均在 3 个月内缓解。2 例患者出现融合器塌陷, 无明显不适。所有手术节段均获得植骨融合, 无内固定松动、断裂。**结论:**XLIF 联合双侧椎弓根螺钉固定技术治疗腰椎滑脱症, 椎体复位及椎管间接减压效果满意, 是一种治疗腰椎滑脱症安全、有效的术式。

【关键词】侧路椎间融合; 微创; 腰椎滑脱症; 间接减压

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【Abstract】 Objectives: To investigate the clinical outcomes and radiographic evaluation of bilateral pedicle screw instrumented (XLIF)extreme lateral interbody fusion for the treatment of lumbar spondylolisthesis. **Methods:** Clinical data of patients with lumbar spondylolisthesis treated with bilateral pedicle screw instrumented XLIF in Guangzhou General Hospital of Guangzhou Military Command from September 2014 to August 2016 were analyzed retrospectively. The study cohort consisted of 18 females and 3 males with an average age of 57.0 ± 13.3 (45-77) years. The mean follow-up was 18.0 ± 5.0 (12-29) months. Clinical outcomes were evaluated by using ODI(Oswestry disability index) and VAS(visual analogue scale) scores before surgery and at final follow-up. Anterior-posterior diameter of canal was assessed by MRI before surgery and 3 days after surgery. Foraminal height, disc height and slipping percentage were evaluated with plain lateral radiographs before surgery and at final follow-up. Fusion rate and cage subsidence were assessed on CT scans at final follow-up. **Results:** VAS scores for back pain before surgery and at final follow-up were 5.9 ± 1.7 and 1.7 ± 0.7 re

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spectively. VAS scores for leg pain before surgery and at final follow-up were 6.1 ± 2.1 and 1.4 ± 0.7 respectively. ODI scores before surgery and at final follow-up were $(42.6 \pm 24.8)\%$ and $(12.1 \pm 4.2)\%$ respectively. VAS and ODI scores showed statistically significant improvements ($P < 0.05$). Disc height was 7.2 ± 1.2 mm before surgery and 10.2 ± 1.4 mm at final follow-up. Foraminal height was 17.3 ± 2.9 mm before surgery and 20.0 ± 1.7 mm at final follow-up. Anterior-posterior diameter of canal was 11.2 ± 3.8 mm before surgery and 12.7 ± 4.0 mm at final follow-up. Slipping percentage was $(16.4 \pm 7.0)\%$ before surgery, and $(6.1 \pm 6.6)\%$ at final follow-up. These radiographic parameters showed statistically significant improvements ($P < 0.05$). No severe complications associated with great vessel, abdominal viscera or genitofemoral nerve were observed. 5 patients presented with transient anterior thigh numbness, and the symptoms were resolved within 3 months. 2 patients showed cage subsidence, without obvious discomfort. Solid fusion was observed in all patients, and no fixation failure was found. **Conclusions:** The bilateral pedicle screw instrumented XLIF for the treatment of lumbar spondylolisthesis results in effective restoration of spondylolisthesis vertebra and an increase of the spinal canal at the operated levels via indirect decompression. XLIF is a treatment option available for lumbar spondylolisthesis, which is safe and efficient.

[Key words] Lateral interbody fusion; Minimally invasive; Spondylolisthesis; Indirect decompression

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极外侧入路腰椎间融合术 (extreme lateral interbody fusion, XLIF) 是一种较新的腰椎椎间融合术,其可以经腹膜后入路,在直视下行椎间盘切除及椎体间融合操作。腰椎滑脱症在影像学上主要表现为椎体滑脱、椎间隙塌陷及椎管狭窄等,采用 XLIF 治疗可对椎管进行间接减压,进而改善患者症状。本研究回顾性分析 2014 年 9 月~2016 年 8 月在我院采用 XLIF 联合双侧椎弓根螺钉固定治疗腰椎滑脱症患者,探讨其临床疗效,报道如下。

1 资料与方法

1.1 一般资料

纳入标准:(1)经过 6 个月保守治疗无效的腰痛、下肢痛、间歇性跛行;(2)X 线、CT 及 MRI 检查提示单节段腰椎滑脱(I~II 度);(3)手术方式为 XLIF 联合双侧椎弓根螺钉固定;(4)术后随访时间至少 12 个月。

排除标准:(1)伴有严重黄韧带肥厚及关节突增生;(2)手术节段存在既往手术史,包括后方减压或融合手术;(3)高位髂骨遮挡的 L4/5 或 L5/S1 节段疾病;(4)多节段腰椎滑脱患者;(5)有腰椎骨折、肿瘤、感染等病史者。

经筛选,本研究共纳入腰椎滑脱症患者 21 例,其中女性 18 例,男性 3 例,均为单节段滑脱。年龄 45~77 岁,平均 57.0 ± 13.3 岁。术后随访时间 12~29 个月,平均 18.0 ± 5.0 个月。19 例患者诊断为退变性腰椎滑脱症,2 例患者诊断为峡部裂性

腰椎滑脱症;手术节段均为 L4/5,均采用后路 XLIF 联合双侧椎弓根螺钉固定。

1.2 手术方法

所有患者均由同一位经验丰富医师采用 XLIF 术式完成手术。患者全麻后取侧卧位,腰部及肋腹部垫圆枕,同时折叠腰桥,增加髂棘与肋弓之间的距离,便于术中显露。术前透视明确手术节段及切口位置。消毒铺巾后,依术前定位标记处切开皮肤及皮下组织,钝性分离腹壁肌肉直至腹膜后间隙。手指将腹膜向前推移,触摸腰大肌表面。随后将导针经腰大肌插入相应手术节段,透视确认手术节段及导针位置后逐级放置 XLIF 扩张通道,最后固定工作通道。使用配套的器械切除椎间盘并行椎间融合术。融合器大小为 $(50 \sim 55) \times 18 \times (8 \sim 12)$ mm。而后将患者置于俯卧位,采用椎旁肌间隙入路为患者实施后路椎弓根螺钉内固定,使用连接棒固定。所有患者均未行后路减压手术。确认术野无明显活动性出血后,逐层缝合切口,术毕。

1.3 观察指标

通过术前及末次随访疼痛视觉模拟评分 (visual analogue scale, VAS) 及 Oswestry 功能障碍指数 (Oswestry disability index, ODI) 评价患者症状改善情况。测量术前及术后 3d 轴位的 MRI (T2 加权) 的椎管前后径 (anterior-posterior diameter of the canal, APDC) (图 1); 测量术前及末次随访腰椎侧位 X 线的椎间孔高度 (foraminal height, FH)、椎间隙高度 (disc height, DH) (前、后椎间隙

高度的平均值)、滑移百分比^[1](slipping percentage, SP)(SP=椎体滑移距离/下节段椎体上终板前后径×100%)(图 2)。术后随访 1 年以上 CT 观察融合率及融合器塌陷情况。融合器塌陷程度根据融合器塌陷比例进行分级^[2]:0 级, 0%~24%; I 级, 25%~49%; II 级, 50%~74%; III 级, 75%~100%。

1.4 统计学处理

采用 SPSS 22.0 软件进行统计学分析, APDC、VAS、ODI 评分、DH、FH、SP 计量资料以均数±标准差表示。满足方差齐性后, 以配对样本 *t* 检验比较术前及术后末次随访的差异; 如不满足方差齐性, 则采用 Wilcoxon 检验。 *P*<0.05 为差异

有统计学意义。

2 结果

术前及末次随访时腰痛 VAS 评分、ODI 比较差异均有统计学差异(*P*<0.05, 表 1)。术前及术后 3d 的 APCD 术前 11.2±3.8mm, 术后 3d 为 12.7±4.0mm, 差异有统计学意义(*P*<0.05)。术前及末次随访时手术节段 DH、FH、SP 比较差异均有统计学意义(*P*<0.05, 表 2)。所有患者均无大血管、腹腔脏器、生殖股神经损伤等严重并发症。术后 5 例(24%)患者出现大腿前方感觉麻木, 术后 3 个月内均缓解。术后 1 年复查, 所有患者椎间植骨均获

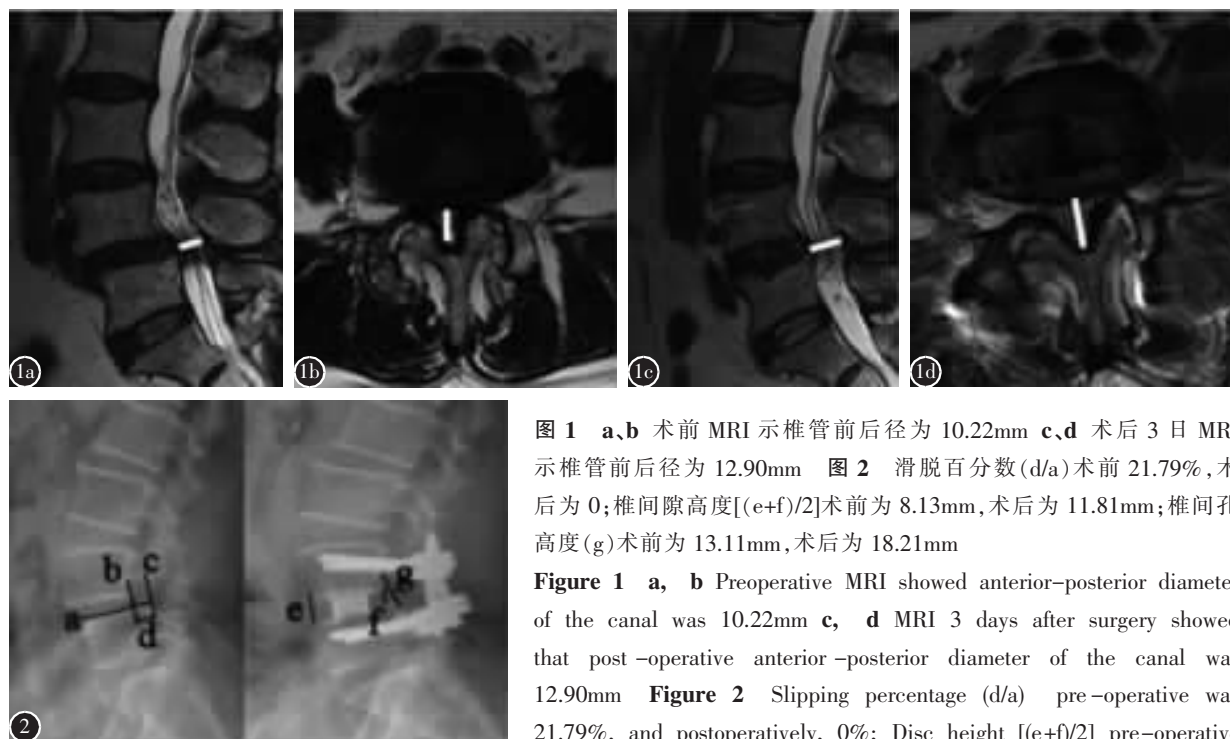


图 1 a、b 术前 MRI 示椎管前后径为 10.22mm c、d 术后 3 日 MRI 示椎管前后径为 12.90mm 图 2 滑脱百分数(d/a)术前 21.79%, 术后为 0; 椎间隙高度[(e+f)/2]术前为 8.13mm, 术后为 11.81mm; 椎间孔高度(g)术前为 13.11mm, 术后为 18.21mm

Figure 1 a, b Preoperative MRI showed anterior-posterior diameter of the canal was 10.22mm c, d MRI 3 days after surgery showed that post-operative anterior-posterior diameter of the canal was 12.90mm Figure 2 Slipping percentage (d/a) pre-operative was 21.79%, and postoperatively, 0%; Disc height [(e+f)/2] pre-operative was 8.13mm, and postoperatively, 11.81mm; Foraminal height (g) pre-operative was 13.11mm, and postoperatively, 18.21mm

表 1 术前及末次随访时 VAS 和 ODI 评分
Table 1 VAS score and ODI score before surgery and at final follow-up

	术前 Preoperation	末次随访 Final follow-up
腰痛 VAS(分) VAS for back pain	5.9±1.7	1.7±0.7 ^①
腿痛 VAS(分) VAS for leg pain	6.1±2.1	1.4±0.7 ^①
Oswestry 功能障碍指数(%) Oswestry disability index	42.6±24.8	12.1±4.2 ^①

注:①与术前比较 *P*<0.05

Note: ①Compared with preoperation, *P*<0.05

表 2 术前及末次随访时影像学测量结果
Table 2 Radiographic results before surgery and at final follow-up

	术前 Preoperation	末次随访 Final follow-up
椎间隙高度(mm) Disc height	7.2±1.2	10.2±1.4 ^①
椎间孔高度(mm) Foraminal height	17.3±2.9	20.0±1.7 ^①
滑脱百分数(%) Slipping percentage	16.4±7.0	6.1±6.6 ^①

注:①与术前比较 *P*<0.05

Note: ①Compared with preoperation, *P*<0.05

融合。术后无内固定松动、断裂,2 例(9%)患者出现融合器下沉,均为 I 级,无明显不适;余 19 例均为 0 级。

3 讨论

既往文献表明,XLIF 具有出血少、手术时间短、术后恢复快等优点^[13-18]。Pereira 等^[19]分析了 23 例采用 XLIF 治疗的腰椎滑脱症患者,结果表明微创 XLIF 对于合并多种基础疾病的腰椎退变患者尤为适用。Karikari 等^[20]为 66 例 77 岁以上的腰椎退行性疾病患者采用 XLIF 治疗,结果表明,高龄患者采用 XLIF 手术,心肌梗死、肺栓塞等严重并发症的发生率较低。

XLIF 完整保留了前、后纵韧带,术中通过前、后纵韧带的张力作用可以很好地恢复脊柱序列;而且通过恢复椎间隙高度,从而伸展皱褶的黄韧带和纤维环以及恢复椎间孔容积,从而达到间接减压的目的^[16,21]。Oloveria 等^[16]的研究表明,XLIF 术后椎间隙高度增加了 41.9%,椎间孔高度增加了 13.5%,椎间孔面积增加了 24.7%,椎管前后径增加了 33.1%。Khajavi 等^[22]在研究中发现,末次随访,ODI、VAS 腰痛评分及 VAS 腿痛评分较术前分别改善 51%、71%和 65%;椎间孔高度、宽度、面积较术前分别增加 19.7%、18.0%、39.6%;椎体滑脱百分数较术前改善 69.2%。Ahmadian 等^[18]报道,末次随访 VAS 评分、ODI 评分及 SF-36 评分及显著改善;27 例(87.1%)患者术后椎体滑脱完全复位,4 例(4.9%)部分复位,所有手术节段均获得植骨融合。本组病例中,术后 DH、FH、APDC、SP、ODI 及 VAS 评分均较术前显著改善。

根据 Benglis 等^[23]、Uribe 等^[24]报道,L4/5 节段术中更容易损伤腰丛及生殖股神经。此外,椎体滑脱会改变区域内神经、血管走行,术中损伤神经血管的可能性增大。术中采用神经电生理可在一定程度上减少神经损伤的几率,但是神经电生理只能监测运动神经,无法监测像生殖股神经、股外侧皮神经等感觉神经^[24]。本组病例中未出现严重的神经损伤,但早期病例中术后出现大腿前侧麻木 5 例,术后 3 个月内大部分得到缓解或消失,考虑通道置入时引起神经激惹相关。一些学者也报道了类似的并发症^[18,23,25]。根据我们的经验,L4/5 节段放置通道过程中稍靠前,然后再将通道向后推,可降低损伤腰丛及生殖股神经的几率。Louie 等^[26]

报道称,当 L4/5 节段轴位 MRI 图像上呈野泪滴状时,腰丛会随着腰大肌向前移位,术中神经损伤的几率也会增加。Voyadzis 等^[27]报道,3 例 L4 椎体滑脱患者因术前轴位 MRI 提示“腰大肌上升迹象”(也叫“泪滴状”)而改行后路手术。术前的 MRI 不能清楚地显示腰丛的位置,只能依靠 MRI 轴位腰大肌的形态及位置来推断腰丛的位置。后方入路的选择一般是根据患者的临床症状、体征,而 XLIF 入路的选择更多考虑到神经血管的位置。因此 XLIF 术前必须要完善 MRI 检查,以评估手术的安全性并确定手术入路,避免术中神经损伤。

融合器塌陷在腰椎融合手术并不罕见,本研究中发现 2 例患者出现融合器塌陷(I 级)。引起融合器塌陷的原因很多,但目前研究表明,融合器宽度不足可能是融合器塌陷的主要原因^[28]。较宽的融合器有更大的接触面积,终板载荷更小,可降低融合器塌陷率^[2]。而坚固的内固定可增加脊柱的稳定性、避免融合器下沉,维持间接减压的效果,对于骨质疏松的患者尤其重要^[16]。笔者认为,术中切除软骨终板时应避免损伤骨性终板,若不慎损伤,术中应考虑使用后路椎弓根螺钉固定,避免术后椎间隙塌陷。术中应避免椎间隙过度撑开,直接导致终板损伤。

XLIF 为经腹膜后及腰大肌肌纤维的侧方入路,术中一般不涉及对血管及腹腔脏器的显露,且距离较远,损伤的机会小。但术中需要避免对走行于腰大肌内的腰丛损伤。对于Ⅲ度、Ⅳ度腰椎滑脱症,因椎体移位明显,可能导致邻近的神经、血管位置发生较明显的改变,术中置入通道过程中损伤的机率增加,加之侧路对滑脱椎体的复位有限,因此,必须严格把握 XLIF 手术适应证,才能在减小并发症的前提下达到有效减压及微创的目的。

综上所述,本研究初步验证了 XLIF 联合双侧椎弓根螺钉固定治疗腰椎滑脱症的可行性、安全性及有效性。但是本研究存在样本量小、随访时间短、未研究融合率等限制,因此远期疗效仍需经大样本的长期随访及研究。

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