

## ·非血管介入 Non-vascular intervention·

## 经皮骶 2 髂骨三皮质螺钉治疗老年无神经症状下腰椎椎间盘炎的近期疗效分析

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**【摘要】** 目的 研究经皮骶 2 髂骨三皮质螺钉(S2AI)治疗老年无神经症状下腰椎椎间盘炎近期疗效。**方法** 回顾性分析 28 例于沈阳军区总医院骨科脊柱病区接受 S2AI 内固定术的无神经症状的下腰椎椎间盘炎患者,所有患者均由同一术者完成,共完成 56 枚经皮 S2AI 内固定术,年龄 71~79 岁,所有病变节段均为 L4~L5 和 L5~S1 节段,术后平均随访时间 6.67 个月,分析本组患者的平均手术时间、术中失血量、术后下床时间、平均住院日、术后切口愈合情况,并比较分析术前、术后 1 周、术后 6 个月的 Oswestry 功能评分、目测类比评分、红细胞沉降率、C 反应蛋白,并通过复查术后 CT 分析内固定松动情况。**结果** 本组患者平均手术时间为(158.12±4.32) min、术中平均失血量为(25.34±3.23) ml、术后平均下床时间为(1.34±0.35) d、平均住院日为(7.29±1.34) d、术后仅有 1 例患者出现切口 S2AI 切口愈合不良,术后切口愈合率为 96.42%,1 例患者右侧 S2AI 螺钉出现松动,螺钉松动率为 1.79%;术后 1 周和 6 个月 Oswestry 功能评分分别为 32.21 和 23.2,且与术前比较  $P$  值均 $<0.05$ ;术后 1 周和 6 个月目测类比评分分别为 2.17 和 1.25,且与术前目测类比评分比较  $P$  值均 $<0.05$ ,术后 1 周和 6 个月红细胞沉降率和 C 反应蛋白分别为 15.32 mm/h、7.89 mg/L 和 14.56 mm/h、8.9 mg/L,且与术前比较  $P$  值均 $<0.05$ 。**结论** 经皮 S2AI 内固定术具有创伤小、失血少、术后下床时间早,且能够明显改善无神经症状下腰椎椎间盘炎的症状等优点,具有良好的近期临床疗效。

**【关键词】** 椎间盘炎;脊柱微创固定;骶骨骨盆内固定;髂骨螺钉;经皮骶 2 髂骨三皮质螺钉  
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**Percutaneous S2-alar-iliac screw fixation for lower lumbar spondylodiscitis with no neurological symptoms in elderly patients: analysis of short-term curative effect** XIE Yanchun, XIANG Liangbi, LIU Jun, XUAN Anwu, LI Zhuo, YU Hailong. Ward of Spine, Department of Orthopaedics, General Hospital of Shenyang Military Region, Shenyang, Liaoning Province 110016, China

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**【Abstract】 Objective** To evaluate the short-term efficacy of percutaneous S2-alar-iliac screw (S2AIS) fixation for the treatment of lower lumbar spondylodiscitis with no neurological symptoms in elderly patients. **Methods** The clinical data of 28 patients of lower lumbar spondylodiscitis with no neurological symptoms, who were admitted to the Ward of Spine, Department of Orthopaedics, General Hospital of Shenyang Military Region, China, to receive percutaneous S2AIS fixation, were retrospectively analyzed. The operation was performed by the same surgeon for all patients. A total of 56 S2AIS fixation procedures were accomplished. The patients' age varied from 71 to 79 years old. The spondylodiscitis was located at L4-L5 or L5-S1. After the treatment, the patients were followed up for a mean of 6.67 months. The mean operative time, the amount of intraoperative blood loss, the postoperative bed time, the average hospitalization days and the postoperative wound healing were documented and analyzed. The Oswestry score, visual analogue score, erythrocyte sedimentation rate, C reactive protein level were determined before operation as well as at one week and 6 months after operation, and postoperative CT was performed to check the loosening of internal screw fixation. The results were compared and analyzed. **Results** The mean operative time was

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(158.12±4.32) min, the average amount of intraoperative blood loss was (25.34±3.23) ml, the average postoperative bed time was (1.34±0.35) d, and the average hospitalization time was (7.29±1.34) d. Poor surgical incision healing was seen in only one patient, and the postoperative wound healing rate was up to 96.42%. Loosening of right S2AIS was detected in one patient, with the screw loosening rate being 1.79%. The Oswestry scores determined at one week and 6 months after treatment were 32.21 and 23.20 respectively, which were significantly different from the preoperative score ( $P<0.05$ ). The visual analogue scores determined at one week and 6 months after treatment were 2.17 and 1.25 respectively, which were significantly different from the preoperative score ( $P<0.05$ ). At one week and 6 months after treatment, the erythrocyte sedimentation rates were 15.32 mm/h and 14.56 mm/h respectively, and the C reactive protein levels were 7.89 mg/L and 8.90 mg/L respectively, both of which were significantly different from the preoperative ones (both  $P<0.05$ ).

**Conclusion** For the treatment of lower lumbar spondylodiscitis with no neurological symptoms in elderly patients, percutaneous S2AIS fixation has certain advantages, such as less trauma, less blood loss, early postoperative ambulation, remarkable improvement of clinical symptoms, etc. with satisfactory short-term clinical efficacy. (J Intervent Radiol, 2018, 27: 53-57)

**【Key words】** spondylodiscitis; minimally-invasive spine stabilization; sacropelvic fixation; iliac screw; percutaneous S2-alar-iliac screw

无神经症状下腰椎间盘炎在合并多种内科疾病的老年患者中非常常见<sup>[1-2]</sup>,其主要临床表现为腰痛和发热。传统的治疗方式主要是药物治疗和支具治疗,但当保守治疗无效或患者合并进行性椎体骨质破坏或神经损伤加重时则考虑行手术治疗。对于下腰椎因为脊柱应力集中节段,椎间盘炎最理想的手术方式为前路病灶清除、椎体前柱重建,但此类手术时间较长、创伤较大、失血较多,对于高龄患者围手术期风险较大。后路椎弓根钉棒系统内固定术既可以为感染的脊柱提供短期的稳定性,又可以联合前路病灶清除内固定术,且感染治愈后可以取出椎弓根钉棒系统<sup>[3-4]</sup>。但传统的椎弓根钉棒系统需要切开胸腰筋膜和广泛剥离椎旁肌肉以显露进钉点的解剖标志,同样不适合于高龄且全身状态欠佳的患者。经皮椎弓根置钉具有切口小、创伤小、失血少、术后恢复快及住院时间短的优点<sup>[4-9]</sup>。但对于下腰椎椎间盘炎后路内固定需要腰椎椎弓根螺钉联合脊柱骨盆内固定术,虽然髂骨螺钉内固定技术(IS)为临床中最常使用的内固定技术,但髂骨螺钉具有如下缺点:髂骨螺钉需要转换器与腰椎椎弓根螺钉连接、远期螺钉定位暴露于皮肤以外、顽固性的臀部疼痛、置钉时需要剥离更多的软组织等,骶2髂骨三皮质螺钉内固定术(S2AI)为近些年文献报道可替代髂骨螺钉并且避免上述缺点的内固定术,目前文献报道 S2AI 主要应用于脊柱矫形手术中的长节段融合<sup>[5-9]</sup>,且均为传统的切开置钉方法,本研究通过回顾性分析报道经皮 S2AI 治疗老年无神经

症状下腰椎椎间盘炎患者的近期疗效。

## 1 材料与方法

### 1.1 一般患者资料

本组患者共 28 例,男 17 例、女 11 例,年龄 71~79 岁,平均(75.2±1.7)岁,所有病变节段均为 L4~L5 或 L5~S1 节段,其中 L4~L5 节段 19 例、L5~S1 节段 9 例,术后平均随访时间 6.67 个月,本组所有患者术前均未合并神经功能缺损,且均有同一术者完成,术前均行腰椎 MR 检查(见图 1)。

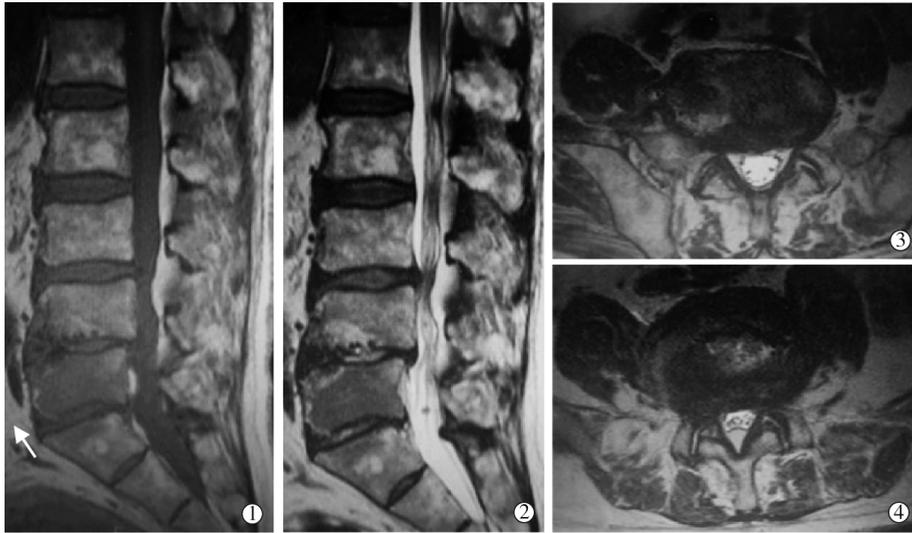
### 1.2 方法

**1.2.1 评估指标** 分析本组患者的平均手术时间、术中失血量、术后下床时间、平均住院日、术后切口愈合情况,并比较分析术前、术后 Oswestry 功能评分和目测类比评分、检测红细胞沉降率(ESR)、C 反应蛋白(CRP),并通过复查术后 CT 分析内固定松动情况。

**Oswestry 功能评分:**从疼痛强度、个人生活自理能力、提物、步行、坐位、站立、对睡眠干扰情况、性生活、社会生活及旅行 10 个方面进行评分,得分越高说明患者功能障碍越严重。

**疼痛评分标准(0~10 分):**0 分:无痛;3 分以下:有轻微的疼痛,能忍受;4~6 分:患者疼痛并影响睡眠,尚能忍受;7~10 分:患者有渐强烈的疼痛,疼痛难忍,影响食欲,影响睡眠。

**1.2.2 手术方法** 全麻后取俯卧位,行后正中 2 cm 切口,切开深筋膜后使用穿刺针穿刺定位,正位 X

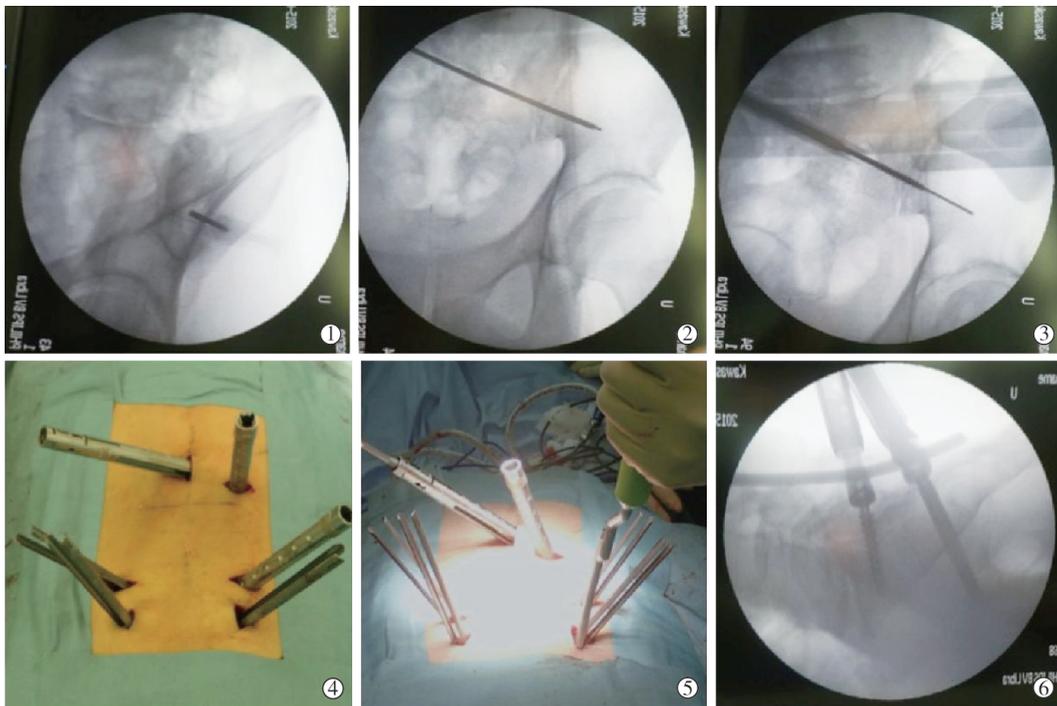


①为 T1 矢状面加权,显示:L4~L5 椎体及椎间隙信号减低、L4~L5 椎间隙塌陷;②为 T2 矢状面加权,显示 L4~L5 椎间盘及 L4 下终板高信号改变、L5 椎体信号减低;③为 L4~L5 轴位未见明显 L4~L5 硬膜囊及神经根受压;④为 L5~S1 轴位未见 L5~S1 硬膜囊及神经根受压

图 1 术前 MR 所见

线透视选择背侧 S1 骶孔外、上 4 mm 为 S2AI 螺钉进钉点,穿刺针向腹侧及尾侧倾斜,穿刺针向尾侧倾斜的角度为 20°~40°,向腹侧倾斜 40°~50°,穿刺过程中穿刺针必须经过骶髂关节,此步骤是保证螺钉位置和方向的重要步骤。当穿刺针穿过骶髂关节后继续推进穿刺针致髂骨骨板内,但需保证穿刺针针尖不穿破髂骨内板及外板。确认穿刺针位置准

确后置入导丝,并沿导丝使用丝锥攻丝致骶髂关节。完成攻丝后沿导丝拧入 S2AI 螺钉,选取的螺钉直径为 8~10 mm,长度为 80~100 mm。安装连接棒选择从头侧的腰椎椎弓根螺钉向尾侧的 S2AI 螺钉穿入,本组患者均在安装完一侧连接棒后折断经皮长尾螺钉的钉尾后再行对侧 S2AI 螺钉置钉(方便对侧置钉)。(图 2)。



①为术中行 S2AI 螺钉经皮穿刺定位 X 线,穿刺针位于 S2 椎体内;②提示穿刺针已经穿过骶髂关节;③显示穿刺针已经到达髂骨翼;④为经皮 S2AI 螺钉置钉完成后体表图片;⑤为术中安装连接棒图片;⑥为 S1~S2 螺钉侧位 X 线图片

图 2 手术过程

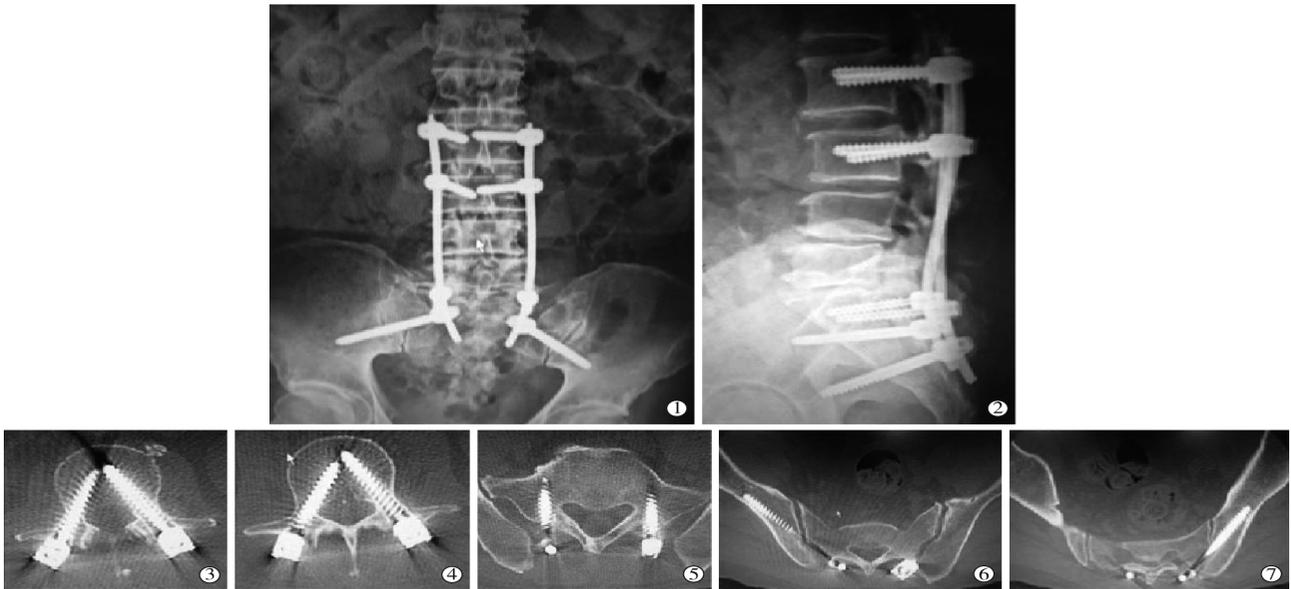
### 1.3 统计学分析

采用 SPSS19.0 统计软件进行数据处理, 术前、术后 Oswestry 功能评分和目测类比评分、ESR、CRP 比较采用 *t* 检验, 以  $P \leq 0.05$  为差异有统计学意义。

## 2 结果

本组患者平均手术时间为  $(158.12 \pm 4.32)$  min、术中平均失血量为  $(25.34 \pm 3.23)$  ml、术后平均下床

时间为  $(1.34 \pm 0.35)$  d、平均住院日为  $(7.29 \pm 1.34)$  d、术后所有 28 例患者中仅有 1 例出现 S2AI 切口愈合不良, 定期换药后愈合良好, 术后切口愈合率为 96.4%、本组所有 56 枚经皮 S2AI 仅有 1 例患者中右侧 S2AI 螺钉出现松动, 螺钉松动率为 1.8%。本组所有患者术后均复查腰椎正侧位及腰骶椎 CT 平扫, 未见椎弓根螺钉及 S2AI 螺钉侵及椎弓根及髂骨皮质(见图 3)。



①②为术后正侧为 X 线片;③~⑤为 L2~S1 椎弓根 CT 平扫, 提示椎弓根螺钉均位于椎弓根骨质内;⑥⑦为双侧 S2AI CT 平扫, 提示双侧 S2AI 螺钉均位于骶骨及髂骨骨板内

图 3 术后复查所见

本组患者术前 Oswestry 功能评分和目测类比评分分别为 78.84 和 9.34, 术后 1 周和 6 个月分别为 32.21 和 23.2, 术后 1 周和 6 个月 Oswestry 功能评分与术前比较差异有统计学意义,  $P$  值均  $< 0.05$ ; 术后 1 周和 6 个月目测类比评分分别为 2.17 和 1.25, 且与术前目测类比评分比较差异有统计学意义,  $P$  值均  $< 0.05$ ; 本组患者术前 ESR、CRP 分别为 134.15 mm/h 和 167.9 mg/L, 术后 1 周、6 个月 ESR、CRP 分别为 15.32 mm/h、7.89 mg/L 和 14.56 mm/h、8.9 mg/L, 术后 1 周和 6 个月 ESR、CRP 与术前比较差异有统计学意义,  $P$  值均  $< 0.05$ 。(见图 4)。

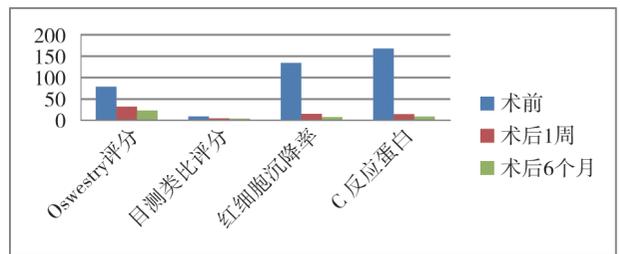


图 4 术后 1 周、6 个月各项指标比较

## 3 讨论

无神经症状的下腰椎椎间盘炎为脊柱外科医师临床工作中常见的问题。近年来经皮椎弓根螺钉内固定术为治疗全身情况欠佳患者腰椎椎间盘炎的有效手术方式, 但下腰椎椎间盘炎通常需要腰椎椎弓根螺钉联合脊柱骨盆内固定术<sup>[4]</sup>。既往文献报

道脊柱骨盆内固定术能够有效地减少假关节的形成以及内固定物失效等并发症, 脊柱骨盆内固定术的主要指征包括: 融合至骶骨的长节段脊柱融合、重度的脊柱滑脱症、减压致尾骨的长节段融合、需要截骨矫形的平背综合征以及需要矫形的骨盆倾斜<sup>[10-11]</sup>。虽然文献报道多种脊柱骨盆内固定术, 但临床最常采用的两种内固定术为 IS 和 S2AI 内固定术。虽然 IS 内固定技术曾经为临床中最常使用的内固定技术, 但相比于髂骨螺钉, S2AI 内固定术具有不需要转换器与腰椎椎弓根螺钉连接、远期螺钉定

位暴露于皮肤以外发生率较低、术后顽固性的臀部疼痛发生率低、螺钉途径三皮质把持力强等优点<sup>[12-15]</sup>。而且, S2AI 内固定术联合腰椎经皮椎弓根螺钉内固定术在上述优点的基础上能够减少传统切开行 S2AI 需要广泛剥离骶骨两侧椎旁肌肉、减轻术中创伤、减少术中失血量、有利于术后早期下床及减少平均住院日。本研究报告中, S2AI 内固定术能够通过微创的方式, 为下腰椎椎间盘炎且全身情况欠佳老年患者提供稳定的内固定方式, 有效患者腰痛症状, 提高患者生活质量。

S2AI 需要将传统腰椎切口向尾端延长 4~5 cm, 且需要剥离骶骨双侧椎旁肌显露背侧骶孔, 手术创伤较大、失血较多<sup>[16-20]</sup>, 本研究提示经 S2AI 可采用小于 2 cm 正中切口即可完成置钉, 而且切口的位置一定要在 S2AI 钉道的方向, 一旦切口的位置与 S2AI 钉道偏离, 在置入导丝过程中可能会出现导丝的位置发生偏离, 严重者会损伤盆腔血管、结肠及臀上皮神经。

总之, S2AI 内固定术既可以为老年无神经症状下腰椎椎间盘炎患者提供稳固的内固定, 又可以有效地改善此类患者的临床症状, 尤其适用于高龄、全身情况欠佳、免疫功能较差等有传统切开手术禁忌证的患者。但 S2AI 内固定术的远期临床效果及并发症仍然需要进一步研究明确。

#### [参 考 文 献]

- [1] Mogharrabi M, Azarhou sh R, Javadi H, et al. Extradural ganglioneuroma with T1-T2 involvement mimicking spondylodiscitis: a case report and a review of the literature[J]. Nucl Med Rev Cent East Eur, 2016, 19: 3-4.
- [2] Yu SH, Kim DH, Kim HS, et al. Infectious spondylodiscitis by uncommon pathogens: a pitfall of empirical antibiotics [J]. Korean J Spine, 2016, 13: 97-101.
- [3] Kothari MK, Shah KC, Tikoo A, et al. Surgical management in elderly patients with tuberculous spondylodiscitis: ten year mortality audit study[J]. Asian Spine J, 2016, 10: 915-919.
- [4] Bangstrup M, Brummerstedt M, Barfod TS. Diagnostics and treatment of spondylodiscitis[J]. Ugeskr Laeger, 2016, 178, pii: V04160271.
- [5] Burns CB, Dua K, Trasolini NA, et al. Biomechanical comparison of spinopelvic fixation constructs: iliac screw versus S2-Alar-iliac screw[J]. Spine Deform, 2016, 4: 10-15.
- [6] Mazur MD, Mahan MA, Shah LM, et al. Fate of S2-Alar-iliac screws after 12-month minimum radiographic follow-up: preliminary results[J]. Neurosurgery, 2017, 80: 67-72.
- [7] Ishida W, Elder BD, Holmes C, et al. S2-Alar-iliac screws are associated with lower rate of symptomatic screw prominence than iliac screws: radiographic analysis of minimal distance from screw head to skin[J]. World Neurosurg, 2016, 93: 253-260.
- [8] Hu X, Lieberman IH. Robotic-guided sacro-pelvic fixation using S2 Alar-iliac screws: feasibility and accuracy[J]. Eur Spine J, 2017, 26: 720-725.
- [9] Elder BD, Ishida W, Lo SL, et al. Use of S2-Alar-iliac screws associated with less complications than iliac screws in adult lumbosacropelvic fixation [J]. Spine (Phila Pa 1976), 2017, 42: E142-E149.
- [10] Liu Z, Qiu Y, Yan H, et al. S2 Alar-iliac fixation: a powerful procedure for the treatment of kyphoscoliosis[J]. Orthop Surg, 2016, 8: 81-84.
- [11] Ilyas H, Place H, Puryear A. A comparison of early clinical and radiographic complications of iliac screw fixation versus S2 Alar iliac (S2AI) fixation in the adult and pediatric populations[J]. J Spinal Disord Tech, 2015, 28: E199-E205.
- [12] El Dafrawy MH, Kebaish KM. Percutaneous S2 alar iliac fixation for pelvic insufficiency fracture[J]. Orthopedics, 2014, 37: e1033-e1035.
- [13] Detillon D, de Groot H, Hoebink E, et al. Video-assisted thoracoscopic surgery as a diagnostic and therapeutic instrument in non-tubercular spondylodiscitis[J]. Int J Spine Surg, 2015, 26: 55.
- [14] Tschoko SK, Fuchs H, Schmidt O, et al. Single-stage debridement and spinal fusion using PEEK cages through a posterior approach for eradication of lumbar pyogenic spondylodiscitis: a safe treatment strategy for a detrimental condition[J]. Patient Saf Surg, 2015, 9: 35.
- [15] Siam AE, El Saghir H, Boehm H, et al. Adjacent segment infection after surgical treatment of spondylodiscitis[J]. J Orthop Traumatol, 2016, 17: 41-51.
- [16] Castein J, Pingel A, Kandziora F. Posterior decompression and stabilisation of a spondylodiscitis L4/5[J]. Eur Spine J, 2015, 24 (Suppl 8): S943-S944.
- [17] Lin Y, Li F, Chen W, et al. Single-level lumbar pyogenic spondylodiscitis treated with mini-open anterior debridement and fusion in combination with posterior percutaneous fixation via a modified anterior lumbar interbody fusion approach[J]. J Neurosurg Spine, 2015, 23: 747-753.
- [18] Sur A, Tsang K, Brown M, et al. Management of adult spontaneous spondylodiscitis and its rising incidence[J]. Ann R Coll Surg Engl, 2015, 97: 451-455.
- [19] 冯丽帅, 马旭, 田庆华, 等. 微创介入技术治疗脊柱转移瘤的现状和展望[J]. 介入放射学杂志, 2016, 25: 738-742.
- [20] 金鹏, 孙钢. 对经皮椎体强化术的再认识[J]. 介入放射学杂志, 2016, 25: 463-468.

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