

· 技术创新 ·

腰椎布氏菌病经皮载药硫酸钙置入椎弓钉固定[△]

康冠, 李继东, 邱晓明, 王克竞, 张富强, 张岁锋, 程晴灏, 闫亮, 郭洪章*

(甘肃省人民医院, 甘肃兰州 730000)

摘要: [目的] 介绍腰椎布氏菌病经皮载药硫酸钙和椎弓钉固定的手术与治疗技术和初步临床结果。[方法] 2017年7月—2021年7月对19例腰椎布氏杆菌病患者行上述手术治疗。一侧置入经皮椎弓根螺钉, 另一侧安装 MAST Quadrant 通道系统, 显露关节突关节及感染间隙, 彻底清除病变组织。制备载药硫酸钙颗粒, 并将其经通道置入病变间隙, 用浸润有利福霉素的明胶海绵填塞覆盖。再置入同侧椎弓钉, 完成椎弓钉固定。术后佩戴支具, 进行康复功能锻炼。[结果] 19例患者均顺利完成手术, 无严重并发症。随访时间平均(18.3±8.7)个月, 末次随访时 ESR、CRP 分别为(5.2±2.0) mm/h、(0.8±0.7) mg/L, VAS 评分持续下降至(1.0±0.8)分。至末次随访所有患者均获得骨性愈合, 无感染复发、内固定失败患者。[结论] 在规范抗菌药物治疗的基础上, 经皮载药硫酸钙和椎弓钉固定术微创, 持续缓释放抗菌药物, 利于感染控制, 临床疗效确切。

关键词: 布鲁氏杆菌性脊柱炎, 载药硫酸钙, 经皮椎弓根螺钉内固定

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Percutaneous drug-loaded calcium sulfate and pedicle screw fixation for lumbar brucellosis // KANG Guan, LI Ji-dong, QIU Xiao-ming, WANG Ke-jing, ZHANG Fu-qiang, ZHANG Sui-feng, CHENG Qing-hao, YAN Liang, GUO Hong-zhang. People's Hospital of Gansu Province, Lanzhou 730000, China

Abstract: [Objective] To present the surgical technique and preliminary clinical results of percutaneous drug-loaded calcium sulfate and pedicle screw fixation for lumbar brucellosis. [Methods] A total of 19 patients received abovementioned surgical treatment for lumbar brucellosis from July 2017 to July 2021. After percutaneous pedicle screws were placed on the contralateral side, a MAST Quadrant channel system was installed on the affected side to expose the facet and the infected intervertebral space. The lesion was completely debrided, and then the drug-loaded calcium sulfate particles were prepared and implanted through the channel into the affected intervertebral space, which finally covered with a gelatin sponge immersed with rifomycin. The pedicle screws were placed on the same side, and the screw-rod system was adjusted and fasten. After the operation, rehabilitation function exercise was conducted under protection with a brace. [Results] All the 19 patients were successfully operated on without serious complications, and followed up for (18.3±8.7) months in a mean. At the latest follow-up, all the patients got bony fusion of the affected space without infection recurrence and implant failure, associated with significant decrease of ESR, CRP and VAS score ($P<0.05$), whereas significant improvement in term of ASIA neurological function grade. [Conclusion] On the basis of standardized antimicrobial therapy, percutaneous drug-loaded calcium sulfate and pedicle screw fixation are minimally invasive treatment, with continuous and slow release of antimicrobial drugs, which is conducive to infection control and has definite clinical efficacy for lumbar brucella spondylitis.

Key words: brucella spondylitis, drug-loaded calcium sulfate, percutaneous pedicle screw internal fixation

布氏杆菌病是由布氏杆菌引起的具有传染性的人畜共患变态反应性疾病, 近年来发病呈上升趋势^[1]。“早期、联合、足量、足疗程”应用抗菌药物是治疗布鲁氏杆菌性脊柱炎的基础^[2]。但经严格药物治疗后疼痛症状仍无缓解、椎体破坏加重或出现脊髓神经受压甚至腰椎不稳时, 需行手术治疗。病灶清除植骨融合

内固定术治疗布氏杆菌性脊柱炎已达成共识^[3-5], 但术后复发率可达 5%~30%^[6]。如何避免术后感染复发, 且如何最大限度地促进骨长入、骨融合仍是急需解决的问题。近年来国内外研究显示, 医用硫酸钙人工骨作为药物的缓释载体, 治疗感染性骨缺损成为研究热点。载药硫酸钙治疗骨关节结核及骨髓炎的病例

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作者简介: 康冠, 主治医师, 医学硕士, 研究方向: 脊柱脊髓, (电话)13919159016, (电子信箱)1050089393@qq.com

* 通信作者: 郭洪章, (电话)18793191010, (电子信箱)g_hz@163.com

已有报道,并取得良好的疗效^[7-10]。但载药硫酸钙治疗布鲁氏杆菌性脊柱炎的报道却很少。本研究通过经皮椎弓根螺钉内固定联合通道辅助下病灶清除载药硫酸钙颗粒置入,手术创伤小,疗效确切。报告如下。

1 手术技术

1.1 术前准备

所有患者入院后完善相关检验、检查,给予标准抗布鲁氏杆菌治疗^[2, 6, 11]:多西环素 200 mg/d+利福平 600 mg/d+左氧氟沙星 500 mg/d,如病情严重可加用头孢曲松钠 2 g/d,治疗 6 周,同时给予保肝、护肾及营养、支持治疗,评估病情。术前行腰椎正侧位 X 线片、CT 三维重建及 MRI (图 1a~1d) 检查,记录患者疼痛视觉模拟评分 (visual analog scale, VAS) 评分、美国脊髓损伤协会 (American Spine Injury Association, ASIA) 分级。

1.2 麻醉和体位

采用气管插管全身麻醉,取俯卧位,腹部悬空。

1.3 手术操作

全麻生效后,常规消毒铺巾,贴无菌贴膜。C 形臂 X 线机透视定位,根据术前影像资料,取感染间隙上下椎体椎弓根体表投影处进行穿刺。置入穿刺导针 (图 1e),首先于下肢症状较轻一侧开口、攻丝,置入椎弓根螺钉。再次于后正中线上旁开 2 cm 下肢症状严重一侧,取 4 cm 长纵行切口;逐层切开皮肤、皮下组织,穿刺针穿刺、C 形臂 X 线机透视定位,使其恰巧位于感染间隙关节突关节,置入逐级扩张套管,安装通道系统,撑开并固定通道,安装光源 (图 1h)。通道下充分显露关节突关节,骨刀凿除病变间隙上椎体的下关节突及部分下椎体的上关节突,可见黄韧带。显露并咬除黄韧带,可见硬膜囊张力高,此时有少量淡黄色脓液流出,用 10 ml 空注射器收集脓液。神经拉钩保护神经根,不同规格髓核钳钳取病变髓核组织 (送病检及病原微生物检查),刮匙处理椎间隙内感染灶,使用斜头髓核钳,不开口的状态下钝性探查椎间隙侧缘脓肿破口,钝性分离扩创至双侧腰大肌,使得脓肿充分引流,探查硬膜囊腹侧无压迫,硬膜囊逐渐恢复搏动。使用大量稀碘伏盐水反复冲洗,完毕后用安尔碘浸泡。

制备载药硫酸钙颗粒。以万古霉素 0.5 g [希腊 VIANEX S.A. (PLANT C) 公司]+庆大霉素 4ml (四川大冢制药有限公司)+硫酸钙 5 ml (英国 Biocomposites 公司)+利福平 0.9 g (重庆华邦制药有限公

司)的比例制备载药硫酸钙颗粒。搅拌均匀并根据粘稠度加入适量生理盐水,用自带刮板将膏体涂抹模具上,静置。待其干燥后弯曲模具并轻轻敲打背面,收集颗粒状载药硫酸钙,备用。

吸除手术切口浸泡的安尔碘,再次用生理盐水反复多次冲洗。经通道于病变间隙放置已制备好的载药硫酸钙颗粒,同时填塞浸润有利福霉素的明胶海绵,防止颗粒漏入椎管。取出通道系统,根据先前定位椎弓根位置,旋入本侧经皮钉,置入连接棒,尾帽固定,再次透视见位置良好。电刀仔细止血,清点器械、纱布无误后,放置引流管,逐层缝合深筋膜、皮下组织、皮肤。麻醉复苏后,术者安全返回病房。

1.4 术后处理

术后给予低分子肝素钙常规抗凝,预防血栓形成。佩戴止痛泵止痛,继续规律抗布鲁氏杆菌治疗,口服多西环素 200 mg/d+利福平 600 mg/d,持续 8~12 周,给予保肝、护肾等治疗,定期复查肝功、肾功、血沉等。观察伤口引流量,当引流量<20 ml 时,拔出引流管。术后注意床上翻身、拍背,第 2 d 开始进行四肢主被动功能锻炼。术后 3~7 d 视病情佩戴支具下床活动,同时加强腰背肌功能锻炼。术后 3 个月避免久坐、久站及长时间行走及弯腰负重。术后 1、3、6、12 个月门诊复查血常规、生化、血沉及腰椎正侧位 X 线片、CT 等以判断骨性愈合及内固定稳定情况。以后每半年随访 1 次。

2 临床资料

2.1 一般资料

本组患者 19 例,其中男 12 例,女 7 例,年龄 30~66 岁,平均 (47.3±11.1) 岁。所有患者均有不同程度的牛羊接触史或饮用未经灭菌的羊奶、食用死羊史。布鲁氏杆菌血清凝集试验滴度≥1:160。术中取病灶椎间组织或脓液送病理检查和细菌培养证实为布鲁氏杆菌性脊柱炎。术前影像学表现为单节段感染,排除多节段、跳跃性感染,排除腰椎结核及肿瘤。本研究经医院伦理委员会审批,所有患者均知情同意,签署知情同意书。

2.2 初步结果

手术过程顺利,手术时间平均 (167.6±20.7) min; 出血量平均 (193.2±57.5) ml,术中未发生血管、神经损伤等并发症。所有患者均获随访,随访时间平均 (18.3±8.7) 个月,末次随访时血沉 (erythrocyte sedimentation rate, ESR)、C-反应蛋白 (C-reactive protein, CRP)

tive protein, CRP) 分别为 (5.2 ± 2.0) mm/h、 (0.8 ± 0.7) mg/L, VAS 评分持续下降至 (1.0 ± 0.8) 分。末次随访根据骨愈合 Bridwell 标准, 所有患者均获得骨性愈合 (图 1h)^[12], 无感染复发、内固定失败。神经

功能 ASIA 分级 1 例由 B 级提高到 D 级、2 例由 C 级提高到 E 级、8 例由 D 级提高到 E 级、1 例术后仍为 D 级。典型病例见图 1。

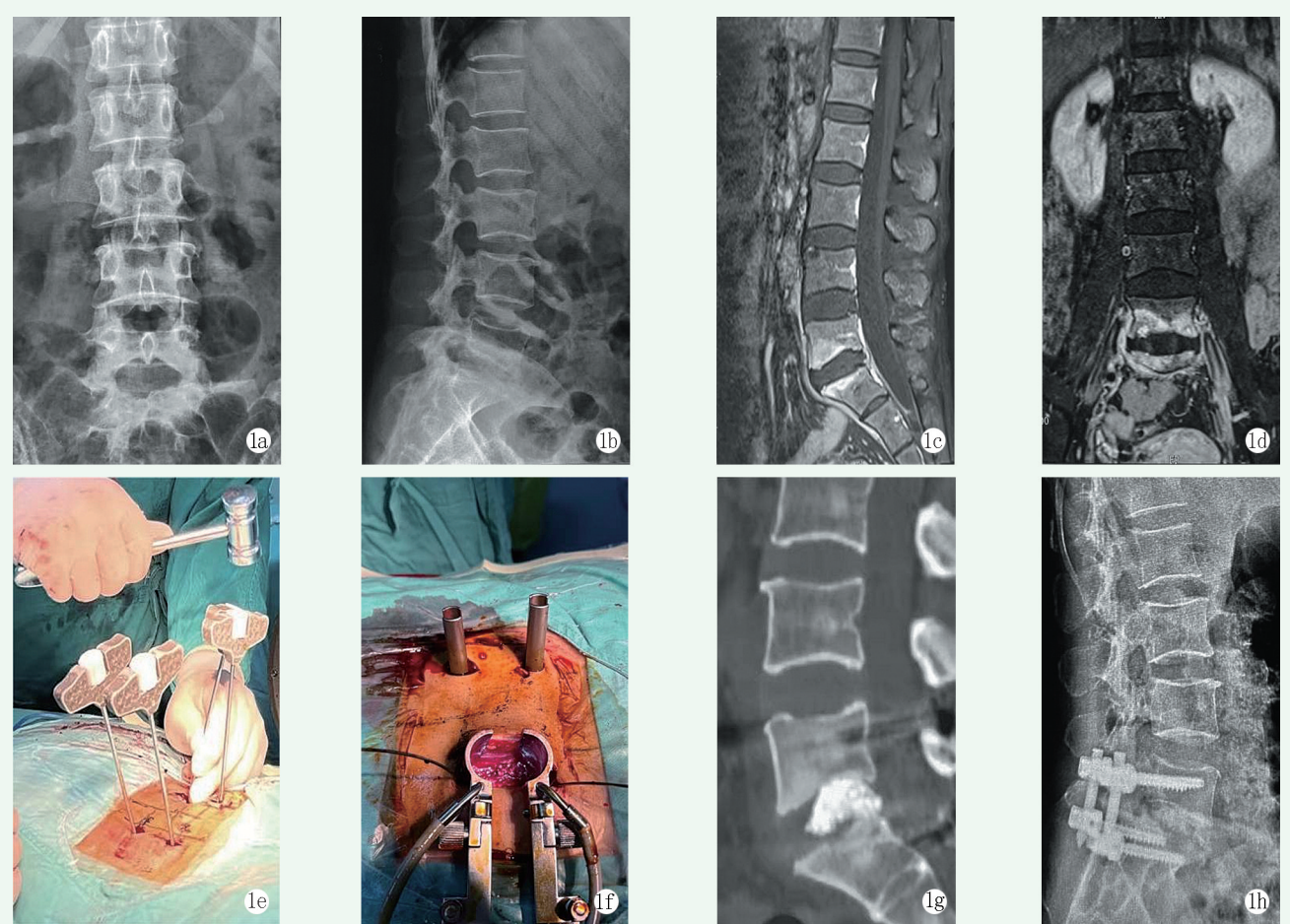


图 1 患者, 女, 43 岁, 布氏杆菌性脊柱炎。1a, 1b: 术前正侧位 X 线片示 L₅S₁ 椎间隙略变窄, 椎板炎改变; 1c, 1d: 术前矢状面、冠状面 MRI 示 T₂WI 像 L₅S₁ 椎间隙信号异常、终板高信号、椎体信号异常; 1e: 术中于 L₅、S₁ 椎弓根体表投影处置入穿刺导针; 1f: 术中一侧经皮椎弓根螺钉固定, 另一侧 L₅S₁ 椎间隙放置通道系统; 1g: 术后 1 周 CT 矢状面示植入 L₅S₁ 椎间隙的硫酸钙颗粒; 1h: 术后 1 年侧位 X 线片示椎间隙已大部分融合。

Figure 1. A 43-year-old female suffered from lumbar brucellosis spondylitis. 1a,1b: Preoperative anterior-lateral radiographs showed slight narrowing of the L₅S₁ intervertebral space with laminitis changes. 1c,1d: Preoperative sagittal and coronal MRI showed abnormal L₅S₁ intervertebral space signal on T₂WI with endplate height signal. 1e: Intraoperative guide pins inserted on the pedicle roots of L₅ and S₁. 1f: Percutaneous pedicle screw fixation was performed on one side, and a channel system was placed in the L₅S₁ intervertebral space on the other side to implant the drug-loaded calcium sulfate particles. 1g: Calcium sulfate particles implanted in the L₅S₁ intervertebral space revealed on sagittal CT 1 week after surgery. 1h: Lateral radiographs 1 year after surgery showed that the vertebral space was mostly fused.

3 讨论

“早期、联合、足量、足疗程”应用抗菌药物是治疗布鲁杆菌性脊柱炎的基础^[2]。张西峰等^[13]认为布鲁氏杆菌性脊柱炎炎症破坏是可逆的, 建议在感染的早期积极行全身的抗感染治疗。Hasanjani 等^[14]也认为对于早期感染患者多数可经保守治疗治愈。但对于经严格药物治疗后疼痛症状仍无缓解、椎体破坏严

重和脊髓神经受压较明显的患者需行手术治疗。目前手术治疗的方式尚存分歧, 且术后感染复发、内固定失败的病例也常有报道^[6]。

通道辅助下经椎间孔入路手术具有微创、疗效显著等优点。买尔旦·买买提^[15]认为一期后路经椎间孔入路病灶清除、植骨融合内固定是治疗脊柱感染简单、有限、安全的手术方式。王栋等^[16]通过对 15 例腰椎布鲁氏杆菌病患者行 Quadrant 通道系统辅助下 MIS-TLIF 技术病灶清除、自体骨植骨融合联合经皮

椎弓根螺钉内固定,取得良好的疗效。该术式虽可通过术前透视定位使通道直达感染病灶、避免肌肉及软组织的过多剥离,最大限度保留了脊柱后方韧带复合体及部分椎板,但由于手术操作视野局限,并不能保证彻底清除病灶,使得术后感染复发的概率大大增加^[17]。本组患者经皮载药硫酸钙和椎弓钉固定术不仅配合经皮椎弓根螺钉内固定术实现了腰椎的即刻稳定,为术后的感染控制、融合固定提供了良好的力学稳定基础^[16],而且术中在充分处理椎间隙及上下终板的基础上,置入包裹有利福霉素、敏感抗生素的载药硫酸钙颗粒,显著降低了感染的复发率。本组19例患者均获随访18个月,无感染复发,无内固定失败,至末次随访,所有患者均获得骨性融合。

硫酸钙骨替代支撑材料,不仅可避免因取自体髂骨对患者造成的二次损伤,更重要的是硫酸钙可以作为缓释材料,在病灶局部持续、高效发挥抗感染作用,同时能诱导骨长入、促进骨融合。传统的聚甲基丙烯酸甲酯抗生素骨水泥不能生物降解,往往需二次手术取出,而载药硫酸钙具有稳定且逐渐吸收的特性^[18]。此外研究发现,硫酸钙能诱导间充质干细胞向成骨细胞分化^[19],促进微血管形成^[20],从而促进成骨。全身应用抗生素是治疗布鲁氏杆菌性脊柱炎的基石,但易引起毒副作用。而本研究通过局部置入载药硫酸钙颗粒,不仅在局部病灶形成高浓度,持续有效杀菌,同时可降低、避免全身毒副作用的发生。但硫酸钙骨水泥常见的不足是伤口周围的渗漏,其发生率为4%~51%^[21]。本研究患者随访均未出现伤口渗漏。与以下3点有关:(1)术中调制抗生素硫酸钙骨水泥保证其呈干燥硬质颗粒状;(2)术中放置较粗的负压引流管,保证引流通畅,防止因硫酸钙絮状溶解物堵塞管道;(3)腰背部手术切口有丰富的肌肉软组织覆盖。

综上所述,腰椎布鲁氏菌病经皮载药硫酸钙和椎弓钉固定术微创、疗效显著、并发症少。但本术式需严格把握手术适应证,术后仍需抗感染治疗。另外,由于本组样本量少,其疗效仍有待大样本、多中心临床研究进一步验证。

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(同行评议专家: 王松, 蓝旭, 李立韬, 罗小波)

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