

脊柱周围深部感染的外科治疗

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【摘要】 目的:探讨脊柱周围深部感染的外科治疗方法及临床疗效。方法:自 2015 年 1 月至 2018 年 1 月收治脊柱周围深部感染患者 7 例,均为脊柱术后 3 周内发生的急性感染。其中男 5 例,女 2 例,年龄 29~67 岁,平均 42 岁。伤口有内植物 4 例,无内植物 3 例。感染确诊后,采用负压封闭引流辅助下彻底清创,局部放置载抗生素人工骨结合全身静脉滴注抗生素,并以血供丰富的组织瓣修复创面的方法治疗。所用组织瓣包括:椎旁肌推进肌瓣 4 例,胸腰筋膜瓣 1 例,背阔肌肌瓣 1 例,椎旁肌推进肌瓣联合胸腰筋膜瓣 1 例。**结果:**术后 7 例患者均获得随访,随访时间 6~24 个月,平均 13.28 个月。随访期间,有内植物的 4 例患者中,除 1 例腰椎融合的患者因术后感染复发而拆除内固定外,其余 3 例成功保留内植物。1 例颈椎骨折脱位患者经背阔肌转位术后感染创面愈合,但供区皮瓣下出现积液,经过穿刺引流,局部加压包扎后治愈。其余 5 例创面获得 I 期愈合,无感染复发、血肿、积液及伤口裂开等术后并发症发生。**结论:**脊柱周围深部感染是一种严重并发症,一旦确诊,应积极治疗。负压封闭引流辅助下彻底清创,局部放置载抗生素人工骨结合全身静脉滴注抗生素,并以邻近组织瓣修复创面是治疗脊柱周围深部感染的一种有效术式。

【关键词】 脊柱; 感染; 引流术; 载抗生素人工骨; 筋膜瓣; 肌瓣

中图分类号:R639

DOI:10.3969/j.issn.1003-0034.2019.10.003

开放科学(资源服务)标识码(OSID):



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ABSTRACT Objective:To study the surgical method and clinical effect of deep infection around the spine. **Methods:**The clinical data of 7 patients with deep infections around the spine treated from January 2015 to January 2018 were retrospectively analyzed. All patients were acute infection within 3 weeks after spinal surgery. There were 5 males and 2 females, aged from 29 to 67 years old with an average of 42 years old. Four of them had implants and the other three didn't. After infection was diagnosed, they accepted aggressive debridement with assistance of vacuum sealing drainage (VSD). The antibiotic artificial bones were put in wounds, combined with intravenous antibiotics. Blood-rich adjacent tissue flaps were used to reconstruct defect of wounds. The tissue flaps included 4 paraspinal muscle flaps, 1 thoracolumbar fascial flap, 1 latissimus dorsi flap and 1 paraspinal muscle combined with thoracolumbar fascial flap. **Results:**All 7 patients were followed up from 6 to 24 months with an average of 13.28 months. During the follow-up period, among the 4 patients with instrument, except one patient of lumbar fusion removed internal fixation due to postoperative infection, the other 3 patients successfully kept the implants. One case of cervical fracture and dislocation was repaired by latissimus dorsi transposition. Its wound healed but hydrops accumulated under the flap. This patient was cured by puncture drainage and local pressure bandaging. The other 5 wounds' healing were first intention and no postoperative complications such as infection recurrence, hematoma, effusion or wound dehiscence occurred. **Conclusion:**Deep infection around the spine is a serious complication and should be treated aggressively once diagnosed. Thorough debridement with the help of negative pressure closed drainage, local application of antibiotic artificial bone combined with systemic intravenous antibiotics and repairing wounds with adjacent tissue flaps are effective procedures for the treatment of deep infection around the spine.

KEYWORDS Spine; Infection; Drainage; Antibiotic artificial bone; Fascia flap; Muscle flap

随着脊柱开放手术、小针刀及封闭注射等侵入性操作的增加,脊柱术后伤口感染有上升的趋势。由于术式不同,伤口感染发生率有所不同,文献报

道^[1-6]其感染率为 0.7%~16%。浅表感染易于处理,而脊柱周围深部感染治疗相对困难,一旦确诊,需尽早手术。目前对于脊柱周围深部感染报道不多^[7-8],尚缺乏统一治疗方案。本院 2015 年 1 月至 2018 年 1 月收治脊柱周围深部感染患者 7 例,采用负压封闭引流(vacuum sealing drainage, VSD)辅助清创,局

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部放置载抗生素硫酸钙人工骨(RBK)结合静滴抗生素,并以邻近组织瓣修复创面,取得了满意的疗效。现报告如下。

1 临床资料

本组 7 例,均为发生在术后 3 周内的急性感染。其中男 5 例,女 2 例,年龄 29~67 岁,平均 42 岁。伤口有内植物 4 例,其中颈椎骨折脱位后路侧块螺钉内固定术后 1 例,胸腰椎骨折内固定术后 1 例,腰椎融合内固定术后 2 例。另外 3 例感染伤口内无内植物,其中腰椎间盘摘除术后 1 例,腰椎内固定拆除术后 1 例,腰椎封闭注射治疗后 1 例。创面组织细菌培养结果:金黄色葡萄球菌 3 例,表皮葡萄球菌 1 例,嗜麦芽寡氧单胞菌 1 例,肺炎克雷伯菌 1 例,铜绿假单胞菌 1 例。7 例患者一般资料见表 1。

2 治疗方法

脊柱周围深部感染诊断明确后,采用全麻下手术清创治疗。沿脓腔外 5 mm 健康组织将感染坏死组织彻底切除,并以 VSD 覆盖创面。经过 1~3 次清创,待创面清洁后,除静脉使用敏感抗生素外,创口内放置含万古霉素(1 g)、庆大霉素(16 万 U)的硫酸钙人工骨作为抗生素缓释剂,以增加局部抗生素浓度,并以血供丰富的邻近组织瓣覆盖创面或填塞死腔来修复深部感染导致的软组织缺损。所用组织瓣包括:胸腰部筋膜瓣修复腰椎封闭注射后局部感染 1 例,背阔肌肌瓣修复颈椎骨折脱位术后伤口感染伴内固定外露 1 例,椎旁肌推进肌瓣联合胸腰部筋膜瓣修复腰椎融合术后伤口感染 1 例,椎旁肌推进肌瓣修复 4 例。

3 结果

术后所有病例获得随访,时间为 6~24 个月,平均 13.28 个月。随访期间,有内植物的 4 例患者中,除 1 例腰椎融合的患者清创缝合术后感染复发,再次清创时拆除所有内植物,并以椎旁肌推进肌瓣联合胸腰部筋膜瓣修复创口后感染控制,其余 3 例成功保留内植物。1 例颈椎骨折脱位患者经背阔肌转位术后感染创面愈合,但供区皮瓣下出现积液,经过穿刺引流,局部加压包扎后治愈。其余 5 例创面获得 I 期愈合,无感染复发、血肿、积液及伤口裂开等术后并发症。典型病例见图 1-2。

4 讨论

随着脊柱手术和侵入性操作的开展,临床上遇到术后脊柱周围深部感染的患者也逐渐增多。脊柱周围深部感染指深筋膜下的感染,包含筋膜及肌肉部位的感染、椎间盘炎、骨髓炎、硬膜脓肿等^[9]。深部组织慢性感染症状隐蔽,早期难以诊断。但急性感染患者早期可出现感染部位红肿热痛、切口开裂、窦道流脓、深压痛等局部症状和体征,也常伴发热、乏力、食欲不振等急性全身中毒症状,血常规可见白细胞升高并伴有中性粒细胞增加,ESR(血沉)、CRP(C-反应蛋白)均可有明显升高,再结合影像学检查,诊断一般并不困难,创口脓液细菌培养可明确致病菌。

脊柱周围深部感染容易沿着腰背筋膜向深部组织蔓延形成脓肿,甚至引起坏死性筋膜炎,感染也可累及骨骼、椎间隙,造成内固定松动失效,一旦确诊,应当积极进行手术治疗。传统方式下,主张对患者的感染伤口进行清创、灌注及较长时间的全身抗感染

表 1 脊柱周围深部感染患者 7 例临床资料
Tab.1 Clinical data of 7 patients with deep infections around the spine

患者	性别	年龄(岁)	感染发生前所行手术	感染发生时间	有无内固定/是否保留内固定	病原菌	修复术式	随访时间(月)	创口愈合情况	并发症
1	男	29	L ₁ 骨折后路切复内固定术	术后 2 周	有内固定/保留	金黄色葡萄球菌	椎旁肌推进肌瓣	12	I 期愈合	无
2	男	48	L _{4,5} 椎间盘突出后路椎间融合术	术后 2 周	有内固定/不保留	耐药金黄色葡萄球菌	椎旁肌推进肌瓣加胸腰筋膜瓣	24	II 期愈合	感染复发
3	男	31	后路开窗腰椎间盘摘除术	术后 5 d	无内固定	表皮葡萄球菌	椎旁肌推进肌瓣	12	I 期愈合	无
4	女	30	腰椎骨折内固定拆除术	术后 1 周	无内固定	嗜麦芽寡氧单胞菌	椎旁肌推进肌瓣	15	I 期愈合	无
5	男	45	腰椎滑移后路融合术	术后 2 周	有内固定/保留	金黄色葡萄球菌	椎旁肌推进肌瓣	12	I 期愈合	无
6	女	44	腰椎间盘突出封闭治疗	术后 1 周	无内固定	肺炎克雷伯	胸腰筋膜瓣	6	I 期愈合	无
7	男	67	颈椎骨折后路切复内固定	术后 2 周	有内固定/保留	铜绿假单胞菌	背阔肌肌瓣	12	I 期愈合	供区皮下积液



图 1 女性患者,44 岁,腰部封闭注射后 1 周发生脊柱周围深部感染。伤口细菌培养:肺炎克雷伯菌(+),经过 2 次 VSD 辅助下清创,创面残留死腔,予静滴抗生素结合局部放置载抗生素人工骨,胸腰筋膜瓣转位修复创面。最终,感染得到治愈 1a,1b。术前 MRI 提示腰骶部右侧椎旁脓肿 1c。术前外观照提示腰骶部右侧肿胀 1d。术中证实椎旁深部感染 1e。清创后 VSD 覆盖创面 1f,1g。设计和切取右侧胸腰筋膜瓣 1h。创面清洁后,局部放置载抗生素硫酸钙人工骨 1i。胸腰筋膜瓣转位修复创面 1j,1k。半年后伤口愈合且感染未复发

Fig.1 A 44-year-old female suffered deep infection around the spine 1 week after local injection. Infectious microorganism of the wound was klebsiella pneumoniae. After two times of VSD-assisted debridement, there was still a residual dead space in the wound. The antibiotic artificial bone was put in the wounds combined with intravenous antibiotics, and the thoracolumbar fascia flap was transferred to repair the wound. The infection was cured finally 1a,1b. Preoperative MRI suggested right paravertebral abscess of the lumbosacral region 1c. Preoperative appearance showed swelling of the right side of the lumbosacral region 1d. Deep infection around the spine was proved during the surgery 1e. The wound was covered by VSD after debridement 1f,1g. Design and cut the right thoracolumbar fascial flap 1h. After the wound was cleaned, the antibiotic calcium sulfate artificial bone was placed locally 1i. The wound was covered with thoracolumbar fascial flap 1j,1k. The wound healed without infection recurrence half a year later



图 2 男性患者,67 岁,车祸致颈椎骨折脱位,在外院行颈椎后路减压复位内固定手术,术后 2 周出现颈椎周围伤口深部感染。伤口细菌培养:铜绿假单胞菌(+)。在本院行清创,背阔肌肌瓣转位,局部放置载抗生素硫酸钙人工骨结合静脉使用敏感抗生素治疗。最终伤口愈合,感染治愈
2a,2b. 术前颈椎正侧位 X 线片 **2c.** 术前伤口外观 **2d,2e.** 经 VSD 辅助下清创后创面变得洁净 **2f,2g.** 设计并切取左侧背阔肌肌瓣 **2h.** 背阔肌肌瓣转位覆盖创面 **2i,2j.** 供区及颈部伤口术后外观 **2k,2l.** 术后 1 年供区及颈部伤口愈合良好,感染未复发

Fig.2 A 67-year-old male patient with cervical fracture and dislocation who accepted posterior spinal decompression and open reduction internal fixation had deep infection around the spine two weeks after surgery. Infectious microorganism of the wound was pseudomonas aeruginosa. After debridement with the aid of VSD, latissimus dorsi muscle flap transposition was performed, and local placement of antibiotic calcium sulfate artificial bone combined with intravenous antibiotic was carried out. At last wound healed, and the infection was cured **2a,2b.** Preoperative AP and lateral X-rays of cervical vertebra **2c.** Preoperative appearance of the wound **2d,2e.** The wound became clean after debridement with the aid of VSD **2f,2g.** Design and cut the left latissimus dorsi muscle flap **2h.** Transposition of latissimus dorsi muscle flap to the wound **2i,2j.** Appearance of donor area and neck wounds **2k,2l.** The donor and neck wounds healed well at 1 year after surgery and the infection did not recur

治疗^[10]。而术后灌洗治疗时伤口常常出现渗漏,需要及时、多次换药,操作起来费时费力。长时间全身应用抗生素会显著增加药物毒副作用、延长住院时间并增加治疗费用。清创后如果出现软组织缺损、残留死腔甚至外固定外露等复杂情况,不进行软组织修复而勉强缝合伤口,术后容易出现伤口积液、裂开以及感染复发等问题。笔者结合修复重建外科的经验,对伤口清创、软组织修复和抗生素使用几个方面的技术进行了改进,使得本组 7 例感染患者均得到治愈,并且 4 例有内植物的患者中 3 例内植物得以保留。

4.1 VSD 辅助下感染创面的彻底清创

感染创面往往需要多次手术清创,以 VSD 填塞死腔及覆盖创面,既能提高清创效果,又可减轻医生换药负担。Labler 等^[11]在其研究中指出,对开放伤口进行负压封闭引流治疗比灌洗系统更有效。伤口内过多的水分会阻碍蛋白质以及成纤维细胞胶原蛋白的合成,负压封闭引流治疗能够减少伤口水分的淤积,降低细胞间隙的压力,增加局部血供,促进伤口愈合。Mehbod 等^[12]研究提示,使用负压封闭引流治疗有利于减少清创手术的次数。近年来,负压封闭引流治疗已经在脊柱感染伤口的临床治疗上得到了越来越广泛的应用。目前国内外许多文献^[13-15]报道在脊柱内固定术后伤口感染患者中应用负压封闭引流治疗能取得满意效果。本组 7 例患者经过 1~3 次 VSD 辅助下的彻底清创,最终创面干净,肉芽新鲜,为进一步软组织修复打下了良好的基础。

4.2 血运丰富的组织瓣填充创腔

为根除感染,清创要象切除肿瘤一样,沿病灶周围的健康组织彻底切除感染坏死组织及炎性瘢痕,这种根治性切除常常会造成伤口内软组织缺损,死腔残留,甚至内植物外露,在处理这类复杂伤口时,早期应用血运丰富的组织瓣覆盖创面或填塞死腔并无张力缝合切口,可以减少感染复发等并发症的发生。文献报道,在需要保留内固定物的情况下,组织瓣移转是修复内固定物外露创面的有效方法^[16]。在肌瓣的选择方面,颈、胸椎和上腰椎的伤口可用斜方肌或背阔肌重建;下腰椎可用椎旁推进肌瓣、筋膜瓣、大网膜或游离背阔肌瓣重建。纵行走向的椎旁肌推进肌瓣技术简单,不需要另做切口,可作为首选修复椎旁软组织感染创面^[17]。没有内植物的伤口,也可使用邻近筋膜瓣转位填塞。对于大的复杂创面,如果一种方法修复有困难,也可几种组织瓣联合应用。本组 1 例腰椎融合术后感染复发病例,联合使用椎旁肌肌瓣和胸腰筋膜瓣获得了成功。国内外多位学者认为脊柱内固定术后感染,在彻底清创的基础上用血供丰富的组织瓣覆盖内植物,大多数内植物均可

保留^[14,18-19]。本组 4 例中有 3 例患者成功保留了内固定,与文献报道相符。

4.3 局部抗生素缓释联合全身抗生素使用

(1)全身抗生素:深部感染通常需要更长疗程的抗生素治疗。在获取药敏结果之前使用广谱抗生素,以后再根据细菌培养的药敏结果选择最敏感的抗生素。(2)局部抗生素:以往的报道^[20]推荐使用局部抗生素骨水泥链治疗。骨水泥可以作为携带抗生素的载体,能在局部形成高浓度的抗生素环境且不良反应低。但抗生素骨水泥链需要取出,操作不便。伤口使用载抗生素硫酸钙人工骨能够增加局部抗生素的浓度和持续时间,并且会逐渐降解吸收,不需要取出。我科使用含抗生素硫酸钙人工骨作为抗生素缓释剂治疗四肢骨髓炎取得了满意的效果^[21-23],而脊柱周围软组织感染伤口使用含有抗生素的硫酸钙尚鲜有报道,本组患者在组织瓣覆盖创面前采用含万古霉素、庆大霉素的硫酸钙人工骨作为抗生素缓释剂局部使用,局部使用长效抗生素缓释剂能长时间在局部发挥抗菌作用,减少静脉使用抗生素的时间,从而节约治疗费用和减少长期静脉使用抗生素所带来的毒副作用。在联合使用载抗生素人工骨后,一般静脉使用敏感抗生素 2~3 周,待伤口拆线,ESR、CRP 恢复正常后即可停药。

综上所述,脊柱周围深部感染是一种严重的并发症,一旦明确诊断,应积极治疗。通过封闭负压引流辅助下彻底清创及富含血运的组织瓣转位修复创面是主要治疗措施,抗生素是重要的辅助治疗,局部应用载抗生素硫酸钙人工骨作为抗生素缓释剂能够提高伤口内抗生素浓度,减轻长时间全身应用抗生素所带来的不良反应。

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(收稿日期:2019-01-21 本文编辑:王宏)