

· 临床研究 ·

前路颈椎单椎体次全切除术中采用髂骨块植骨/Cage填充自体碎骨植骨治疗脊髓型颈椎病

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【摘要】目的 比较前路颈椎单椎体次全切除术中采用髂骨块植骨/Cage填充自体碎骨植骨治疗脊髓型颈椎病(CSM)的中期临床疗效。**方法** 2000年3月—2004年12月采用单椎体次全切除术并自体髂骨块植骨治疗CSM患者21例(A组),2013年1月—2015年12月采用颈椎前路单椎体次全切除术并Cage填充自体碎骨植骨治疗CSM患者32例(B组),对2组患者临床资料进行回顾性分析,对比颈椎整体曲度、融合节段角度、融合节段椎体间高度、融合率、沉降率及颈椎日本骨科学会(JOA)评分等指标。**结果** 术后3d及末次随访时2组颈椎整体曲度、融合节段角度及融合节段椎体间高度与术前相比均显著改善,差异有统计学意义($P<0.05$),组间比较差异无统计学意义($P>0.05$)。A组1例发生植骨未融合,B组无植骨未融合发生。术后3个月及末次随访时2组JOA评分与术前相比均显著改善,差异有统计学意义($P<0.05$),组间比较差异无统计学意义($P>0.05$)。末次随访时B组沉降率(34.3%)高于A组(23.8%),差异有统计学意义($P<0.05$)。2组末次随访时发生沉降者JOA评分与未发生沉降者相比,差异无统计学意义($P>0.05$),并未影响远期临床疗效。**结论** 前路颈椎单椎体次全切除术治疗CSM,与采用传统髂骨块植骨融合相比,术中采用Cage填充自体碎骨植骨可获得相近的影像学及临床疗效,Cage沉降并未显著影响远期疗效。

【关键词】 颈椎;颈椎病;减压术,外科;脊柱融合术;骨移植

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Treatment of cervical spondylotic myelopathy with iliac bone grafting/Cage-filled autologous bone grafting in anterior cervical single segment corpectomy

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【Abstract】Objective To compare the mid-term clinical effect of iliac bone grafting and Cage-filled autologous bone grafting in anterior cervical single segment corpectomy for cervical spondylotic myelopathy(CSM). **Methods** From March 2000 to December 2004, 21 CSM patients were treated with anterior cervical single segment corpectomy and autogenous iliac bone grafting(group A), and from January 2013 to December 2015, 32 CSM patients were treated with anterior cervical single segment corpectomy and Cage-filled autologous bone grafting(group B). The data of 2 groups were analyzed retrospectively. The overall cervical curvature, angle of fusion segment, height of fusion segment, fusion rate, sedimentation rate and Japanese Orthopaedic Association(JOA) score of the cervical spine were analyzed and compared. **Results** The overall cervical curvature, angle of fusion segment and height of fusion segment of the 2 groups on postoperative 3 d and the final follow-up were significantly improved compared with those before the operation, with statistical significances($P<0.05$), but there was no significant difference between the 2 groups($P>0.05$). In group A, 1 patient did not get fused, while all the patients got fused in group B. The JOA scores of the 2 groups in postoperative 3 months and the final follow-up were significantly improved compared with those before the operation, with statistical significances($P<0.05$), but there was no significant difference between the 2 groups($P>0.05$). At the final follow-up, the sedimentation rate of group B(34.3%) was higher than that of group A(23.8%), with a statistical significance($P<0.05$). There was no significant difference in JOA score between patients with and without sedimentation at the final follow-up($P>0.05$), which did not affect the long-term clinical efficacy. **Conclusion** The Cage-filled autologous bone grafting in anterior cervical single segment corpectomy for CSM can provide equal radiography and clinical

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outcome compared with the traditional iliac bone fusion, and the Cage subsidence phenomenon doesn't affect the clinical outcome.

【Key Words】Cervical vertebrae; Cervical spondylosis; Decompression, surgical; Spinal fusion; Bone transplantation

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脊髓型颈椎病(CSM)是造成颈椎严重神经损伤的常见原因,往往需要进行手术减压^[1-2]。前路颈椎椎体次全切除术是一种有效的前路减压方式,可以直接切除颈髓前方的致压物,尤其适用于椎体后纵韧带骨化及骨赘巨大的病例^[3-4]。在椎体次全切除后,使用Cage填充减压椎体骨颗粒进行椎体重建是目前广泛应用的方式,而在Cage出现之前,一般取自体髂骨块进行植骨重建^[5]。与既往的髂骨植骨方式相比,Cage植骨可有效避免取骨区疼痛等并发症,但其过于坚强,存在造成应力遮挡及远期下沉的可能性^[6]。本课题组在前期研究^[7]基础上,对2013年1月—2015年12月采用前路颈椎单椎体次全切除术并Cage填充自体碎骨植骨治疗的CSM患者资料进行回顾性分析,并与2000年3月—2004年12月采用单椎体次全切除术并自体髂骨块植骨治疗的患者资料进行对比,报告如下。

1 资料与方法

1.1 一般资料

2000年3月—2004年12月采用单椎体次全切除术并自体髂骨块植骨治疗CSM患者21例(A组),其中男13例、女8例,年龄(51.9 ± 8.8)岁;椎体切除节段:C₄ 6例,C₅ 13例,C₆ 2例。2013年1月—2015年12月采用前路颈椎单椎体次全切除术并Cage填充自体碎骨植骨治疗CSM患者32例(B组),其中男20例、女12例,年龄(53.1 ± 9.1)岁;椎体切除节段:C₄ 10例,C₅ 18例,C₆ 4例。2组病例均为单椎体次全切除、ABC钢板(蛇牌,德国)固定,手术均由何勃和阮狄克教授主刀完成。2组患者一般资料差异无统计学意义($P > 0.05$),具有可比性。

1.2 手术方法

患者全身麻醉后取仰卧位,头偏向左侧,根据手术切除椎体节段选择锁骨上2~4横指距离沿颈横纹方向行横切口,自血管鞘与内脏鞘间钝性分离到达颈前。透视定位手术节段后切除上下椎间盘,两侧暴露钩椎关节,后方暴露后纵韧带。以咬骨钳咬除椎体至椎体后壁,两侧同上下椎间隙宽度。自下方椎间隙向上交替以刮匙及1 mm椎板咬骨钳咬除椎间隙后纵韧带、椎体后缘皮质骨,暴露硬膜

囊,完成减压。测量椎体间缺损长度,A组于患者髂前取相应长度三面皮质骨,修整后置入椎体间并安装钢板;B组剪取Cage,长度较测量椎间缺损略长2~3 mm,且后缘较前缘略低,将咬除的椎体颗粒骨填充入Cage并压实,牵引头颅下将Cage置入椎体间,前缘与椎体前缘平齐并安装钢板。常规放置引流管后缝合颈阔肌及皮内,术后24~48 h拔除引流管并下床活动,术后常规佩戴颈托8周。

1.3 观察指标

所有患者术前,术后3个月及末次随访时摄颈椎站立位正侧位、过伸过屈动力位X线片,术后3 d仅拍摄正侧位X线片,观察指标包括融合节段椎体间高度、融合节段角度、椎间活动度及棘突尖端距离、颈椎整体曲度。融合节段椎体间高度及角度测量采用Emery法^[8],融合节段上位椎体上终板连线和下位椎体下终板连线间的夹角为椎体间角度,连线中点间距离为椎体间高度。颈椎整体曲度为C₂与C₇椎体后缘延长线间的夹角。棘突间活动度 > 2 mm者定义为可疑不融合病例,进一步行CT重建,以评估融合情况。末次随访时椎体间高度较术后丢失 > 3 mm为置入物沉降。术前、术后3个月及末次随访时采用日本骨科学会(JOA)评分^[9]评价临床功能。

1.4 统计学处理

采用SPSS 15.0软件对数据进行统计学分析,对2组融合节段椎体间高度和角度、颈椎整体曲度及JOA评分进行方差分析;以 $P < 0.05$ 为差异有统计学意义。

2 结果

A组手术时间105~182(145.0 ± 22.8) min,B组手术时间92~163(130.2 ± 25.2) min,组间比较差异无统计学意义($P > 0.05$)。A组术中出血量65~123(85.1 ± 18.8) mL,B组术中出血量30~73(50.4 ± 13.3) mL,差异有统计学意义($P < 0.05$)。A组随访(22.5 ± 4.1)个月,B组随访(20.0 ± 3.8)个月。2组均无内固定松动、断裂及植骨块或Cage明显移位发生。A组1例发生取骨区血肿,无感染,对症治疗后吸收。B组1例术后出现硬膜外血肿,造成脊髓

压迫,急诊行血肿清除手术后神经损伤症状逐步改善。A组1例患者术后3年随访时发现近端假关节形成,融合节段棘突尖部活动度>3 mm,进一步行CT检查,明确为植骨不融合,但患者无明显颈部不适症状,神经功能改善明显;B组未发现融合不良患者。

术后3 d及末次随访时2组融合节段椎体间高度、融合节段角度及颈椎整体曲度与术前相比均显著改善,差异有统计学意义($P<0.05$,表1),但组间差异无统计学意义($P>0.05$,表1)。末次随访时,B

组融合节段椎体间高度低于术后3 d,差异有统计学意义($P<0.05$,表1);B组沉降率(11/32, 34.3%)高于A组(5/21, 23.8%),差异有统计学意义($P<0.05$,表1)。术后3个月及末次随访时2组JOA评分与术前相比均显著改善,末次随访时2组JOA评分较术后3个月有所改善,差异有统计学意义($P<0.05$),但组间差异无统计学意义($P>0.05$,表2);2组末次随访时发生沉降患者JOA评分与未发生沉降者相比,差异无统计学意义($P>0.05$,表2),并未影响远期临床疗效。B组典型病例影像学资料见图1。

表1 2组椎体间高度及角度变化
Tab. 1 Intervertebral height and angle change of 2 groups

分组 Group	n	融合节段椎体间高度/mm Height of fusion segment/mm			融合节段角度/(°) Angle of fusion segment/(°)			颈椎整体曲度/(°) Overall cervical curvature/(°)			沉降率(%) Sedimentation rate(%)
		术前 Pre-operation	术后3 d Postoperative 3 d	末次随访 Final follow-up	术前 Pre-operation	术后3 d Postoperative 3 d	末次随访 Final follow-up	术前 Pre-operation	术后3 d Postoperative 3 d	末次随访 Final follow-up	
A	21	53.5±5.6	58.0±6.0*	56.9±5.5*	0.8±0.6	5.8±1.8*	6.2±2.0*	6.5±2.0	12.1±3.4*	11.2±2.9*	23.8
B	32	54.4±7.5	58.5±6.1*	56.0±5.3*△	1.1±0.5	5.5±2.0*	5.7±1.8*	6.0±2.1	13.5±3.9*	12.1±3.3*	34.3#

注: *与术前相比, $P<0.05$; △与术后3 d相比, $P<0.05$; #与A组相比, $P<0.05$
Note: * $P<0.05$, compared with pre-operation; △ $P<0.05$, compared with postoperative 3 d; # $P<0.05$, compared with group A

表2 2组JOA评分
Tab. 2 JOA scores of 2 groups

分组 Group	n	术前 Pre-operation	术后3个月 Postoperative 3 months	末次随访 Final follow-up	
				发生沉降 With subsidence	未发生沉降 Without subsidence
A	21	11.5±3.2	13.1±2.1*	15.0±3.2*△(n=5)	15.2±2.6*△(n=16)
B	32	10.9±3.0	13.6±2.7*	14.9±2.0*△(n=11)	14.8±2.2*△(n=21)

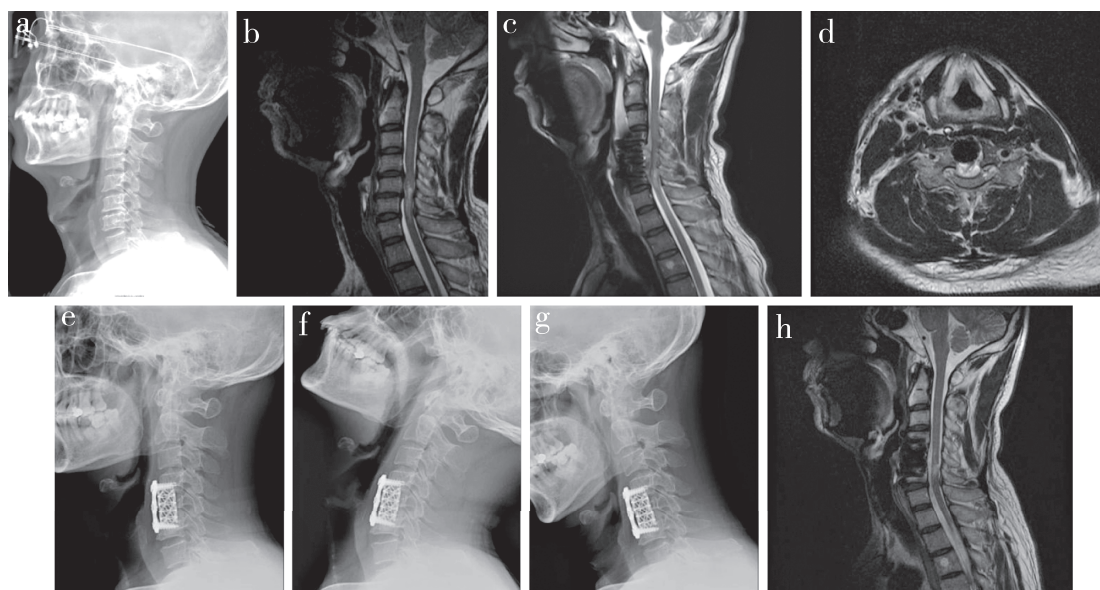
注: *与术前相比, $P<0.05$; △与术后3个月相比, $P<0.05$
Note: * $P<0.05$, compared with pre-operation; △ $P<0.05$, compared with postoperative 3 months

3 讨 论

CSM及后纵韧带骨化症是造成脊髓损伤症状的常见原因,通常需要手术治疗。前路颈椎减压植骨融合内固定术是治疗CSM的重要手术方式,前路减压可以直接去除脊髓前方的压迫、重建颈椎稳定性并恢复颈椎曲度^[1-2]。对于≥2个节段的椎间盘病变,前路颈椎常见的减压方式包括多节段椎间盘切除及椎体次全切除术,相较于椎间盘切除术,椎体次全切除术可以更安全有效地切除椎体后缘体积较大的骨赘及骨化的后纵韧带^[3-4]。减压缺损区的重建既往采用的方法是自体髂骨植骨,并一度被当作

前路颈椎减压植骨融合方式的金标准,但其存在取骨区残留疼痛、局部感染及血肿形成的风险,尤其对于椎体次全切除术,需取体积较大的髂骨块,患者术后常出现系腰带时的不适感^[5]。颈椎Cage的出现避免了取骨区发生潜在并发症的风险,并可有效利用减压后的椎体骨进行填充植骨^[8, 10]。

颈椎前路钢板经历了第一代非锁定双皮质螺钉固定钢板、第二代的锁定单皮质螺钉限制性钢板、第三代的锁定单皮质螺钉非限制性钢板^[11-13]。第三代的非限制性钢板允许螺钉相对于钢板存在角度及头尾端的滑动^[14],除了可分配更多的应力负荷于椎体间植骨处外,还可适配植骨融合界面早期部分吸



男, 53岁, CSM, 行C₅椎体次全切除术 a: 术前X线片示C₅/C₆椎间隙变窄 b: 术前MRI示C₄/C₅/C₆椎间盘退行性变, 髓内高信号 c, d: 术后4 h MRI示Cage后方、硬膜囊前方高信号区, 颈髓受压 e~g: 术后1年X线片示内固定位置良好, 植骨融合 h: 术后1年MRI示脊髓局部压迫消失, 高信号区仍存在

Male, 53 years old, CSM, treated by C₅ subtotal corpectomy a: Preoperative roentgenograph shows narrowing of C₅/C₆ intervertebral space b: Preoperative MRI shows degeneration of C₄/C₅/C₆ intervertebral disc, high signal in spinal cord c, d: MRIs at postoperative 4 h show high signal between Cage and thecal sac, and spinal cord compression e-g: Roentgenographs at postoperative 1 year show good internal fixation position and bone graft fusion h: MRI at postoperative 1 year shows spinal cord compression disappear and high signal still exist

图1 Cage填充自体碎骨植骨病例影像学资料

Fig. 1 Imaging data of a typical case treated by Cage-filled autologous bone grafting

收可能形成的微小缝隙, 利于植骨的融合^[15-16]。尽管颈椎非限制性钢板较限制性钢板有诸多生物力学优势, 但Ragab等^[17]进行的一项前瞻性随机对照研究表明, 限制性钢板与非限制性钢板在植骨融合率、融合时间及沉降率方面相比并没有显著性差异。同样的结论在Goldberg等^[18]的研究中亦被证实。本研究结果显示, Cage植骨与既往髂骨植骨的融合率相当, 同时可避免取骨区的相关并发症, 具有一定的优势。

Cage植骨随访时可观察到较高的沉降率, 虽然这种沉降现象并未显著影响临床疗效及融合率, 但过多的沉降无疑会造成局部椎体间高度及角度的丢失^[19]。如果在减压过程中对椎体终板破坏过多, 或患者有较明显的骨质疏松, 终板及终板下骨的强度不足, 则会造成更显著的沉降, 进而可能影响临床疗效。目前临床上广泛采取术中根据减压椎体间隙高度临时剪裁Cage, 这种剪裁会在钛笼两端留有多多个尖锐的角状突出, 如果终板强度不足, 局部的高应力配合非限制性钢板的使用则可能发生较显著的沉降。对于骨质疏松患者, 应当谨慎采用非限制性钢板结合Cage融合固定的模式, 术前对高龄患者的

骨质情况进行评估是必要的。

本研究发现, 无论是髂骨植骨还是Cage植骨, 术后3个月随访时的JOA评分较术前均显著提高, 末次随访时仍进一步提高, 提示CSM术后临床功能康复过程较长, 但主要的临床功能恢复阶段是术后早期。临床功能的恢复主要取决于减压及融合的效果, 与植骨及固定方式无明显关系。相较于多节段椎间盘切除, 椎体次全切除术并髂骨块植骨的融合部位仅为头尾两端, 可降低假关节形成的发生率^[20-21]。这种机制在Cage填充减压颗粒骨植骨时不复存在, 但从临床随访中可观察到Cage植骨在单椎体切除时仍可获得良好的融合效果, 提示Cage填充减压颗粒骨植骨的融合效果是确切的, 但要明确获得Cage植骨融合的影像学证据较传统的髂骨植骨困难, 即使使用CT重建观察植骨融合界面仍较困难, 融合的判断主要依靠融合节段活动度等间接证据。

综上所述, 前路颈椎单椎体次全切除术治疗CSM, 与采用传统髂骨块植骨融合相比, 术中采用Cage填充自体碎骨植骨可获得相近的影像学及临床疗效, Cage沉降并未显著影响远期疗效。

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