

· 临床研究 ·

Bryan 人工颈椎间盘置换术后疗效评价及并发症分析

蓝旭¹, 许建中², 刘雪梅¹, 葛宝丰¹

(1. 兰州军区总医院创伤骨科, 甘肃 兰州 730050; 2. 第三军医大学西南医院骨科, 重庆 400038)

【摘要】 目的: 观察 Bryan 人工颈椎间盘置换治疗颈椎间盘突出症临床疗效和并发症情况。方法: 2005 年 1 月至 2008 年 12 月, 采用 Bryan 人工颈椎间盘置换治疗颈椎间盘突出症患者 39 例, 男 20 例, 女 19 例; 年龄 35~59 岁, 平均 47 岁。临床症状以脊髓压迫为主者 20 例, 神经根性症状为主者 19 例。单节段置换 35 例, 双节段置换 4 例。术后定期随访, 通过颈椎动态 X 线片, 观察植入假体位移和活动度、颈椎生理曲度、异位骨化及假体融合情况。依照 Odom's 标准和 JOA 评分评估神经功能, 采用 NDI(颈椎残障功能量表) 评定术后临床症状和日常功能状态。结果: 术后随访 16~36 个月, 平均 24 个月。神经功能明显改善, 以神经根性症状为主的上肢放射痛全部缓解。未发现假体前后位移大于 2 mm 的患者, 术后置换假体前后屈伸活动范围(8.5 ± 1.8)°, 左右侧屈活动范围分别为 (3.5 ± 1.2)° 和 (3.3 ± 1.5)°, 颈椎生理曲度明显改善或恢复正常。3 例发生异位骨化, 2 例出现假体融合。Odom's 临床评定: 优 25 例, 良 9 例, 一般 5 例。JOA 评分由术前的 (8.26 ± 1.32) 分增加至终末随访时的 (15.71 ± 1.89) 分。NDI 评分从术前的 (43.7 ± 3.8) 分降低至终末随访的 (20.1 ± 2.9) 分。结论: 人工颈椎间盘置换治疗颈椎间盘突出症有较好的临床疗效, 术后神经功能恢复良好, 颈椎具有较好的稳定性和活动度。但该手术有其特有的并发症, 术后异位骨化和假体融合发生率较高, 应重视手术适应证选择及手术操作规范。

【关键词】 椎间盘; 颈椎; 假体和植入物; 手术后并发症

DOI: 10.3969/j.issn.1003-0034.2013.03.002

Curative effect evaluation and complication analysis of Bryan artificial cervical disc replacement LAN Xu, XU Jianzhong, LIU Xue-mei*, and GE Bao-feng. *Department of Orthopaedics, Lanzhou General Hospital of Lanzhou Military Area, Lanzhou 730050, Gansu, China

ABSTRACT Objective: To observe the curative effects and complications of Bryan cervical disc replacement for cervical disc herniation. **Methods:** From January 2005 to December 2008, 39 patients with cervical disc herniation were treated with Bryan cervical disc replacement. There were 20 males and 19 females, with an average age of 47 years old (ranged, 35 to 59). Spinal compression symptom (20 cases) and nerve root symptom (19 cases) were main clinical symptoms. Single level disc was replaced in 35 cases and two-level replaced in 4 cases. Offset and activity of prosthesis, cervical physiological curvature, heterotopic ossification, prosthetic fusion were observed by dynamic X-ray. According to Odom's standard and JOA score, nerve function were evaluated; and depending on NDI standard, clinical symptom and daily function status were recorded. **Results:** All the patients were followed up from 16 to 36 months with an average of 24 months. Nerve function obviously improved and radiating pain of upper limb completely relieved. No patient with prosthetic anterior-posterior offset more than 2 mm was found. Prosthetic flexion and extension angle was (8.5 ± 1.8)°, left and right flexion range respectively were (3.5 ± 1.2)° and (3.3 ± 1.5)°. Cervical physiological curvature improved obviously or recovered normally. Three cases occurred in heterotopic ossification and 2 cases occurred in prosthetic fusion. According to Odom's standard, 25 cases got an excellent results, 9 good, 5 fair, the rate of excellent and good was 87.2%. JOA score increased from preoperative (8.26 ± 1.32) to (15.71 ± 1.89) at final follow-up and NDI decreased from preoperative (43.7 ± 3.8) to (20.1 ± 2.9) at final follow-up. **Conclusion:** Treatment of cervical disc herniation with Bryan cervical disc replacement can get the good curative effects, which can obtain good nerve functional recovery, cervical stability and activity. Nevertheless, the operation has typical complication such as heterotopic ossification and prosthetic fusion. Thus, it is important in choosing indication and operative procedure.

KEYWORDS Intervertebral disk; Cervical vertebrae; Prostheses and implants; Postoperative complication

Zhongguo Gu Shang/China J Orthop Trauma, 2013, 26(3):182-185 www.zggszz.com

人工颈椎间盘置换可有效避免因经典融合术带来的颈椎运动功能丧失, 提高疗效并改善患者生活质量, 具有良好的应用前景。然而, 随着颈椎非融合技术的广泛应用, 人工颈椎间盘置换术后异位骨化、

假体融合,以及相邻节段椎间盘退变的问题已逐渐成为关注热点^[1]。自 2005 年 1 月至 2008 年 12 月,笔者采用 Bryan 人工颈椎间盘置换治疗脊髓型或神经根型颈椎病患者 39 例,对其中期疗效,以及出现的异位骨化和假体融合情况进行分析总结。

1 资料与方法

1.1 一般资料 本组 39 例,男 20 例,女 19 例;年龄 35~59 岁,平均 47 岁;单节段病变 35 例,双节段病变 4 例。C_{3,4} 3 例,C_{4,5} 5 例,C_{5,6} 12 例,C_{6,7} 15 例,C_{4,5}、C_{5,6} 2 例,C_{5,6}、C_{6,7} 2 例。临床症状以脊髓压迫为主 20 例,主要表现为四肢麻木、肌力下降、行走不稳、反射亢进等。神经根性症状为主 19 例,主要表现为一侧上肢放射性疼痛,相应皮肤区域感觉减退,严重者伴有一侧上肢肌力减退。术前常规行颈椎正侧位、过伸过屈位 X 线和 MRI 检查。动态 X 线片显示病变节段均无不稳定,椎体后缘有少许骨质增生。MRI 提示病变节段有明显椎间盘突出或脱出,5 例局部脊髓信号稍有改变。

1.2 治疗方法 全麻,仰卧位,颈部中立位。取右侧颈前横切口,C 形臂 X 线机透视确定置换间隙后,切除目标间隙纤维环、髓核组织和软骨板至两侧钩突。用球磨钻清理相邻终板前缘的骨赘,切除部分置换间隙上位椎体前下缘。用椎间撑开器逐级撑开椎间隙至 8.5 mm。将矢状位楔形定位器在中点插入椎间隙,放置双轨打磨导向器。选取相应长度的柱状磨钻磨上下位椎体终板,使用相应直径盘状磨钻磨上位椎体下终板和下位椎体上终板至凹床形成。清理突出的髓核组织,并咬除椎体后方增生骨赘。如果后纵韧带破裂,应当切开后纵韧带并取出游离的椎间盘髓核组织,使脊髓充分减压。选择相应规格 Bryan 人工椎间盘植入椎间隙,C 形臂 X 线机透视观察假体位置。放置负压引流管,关闭伤口,术后 24~48 h 后拔除引流管。颈托围领保护 2 周,正常活动颈部并进行项背肌锻炼。术后定期门诊随访,摄颈椎正侧位和动力位 X 线片,部分患者行 CT 或 MRI 检查。

1.3 观察指标与方法

1.3.1 X 线观察 假体稳定性测量:观察假体前后径与椎体前后径差异、假体上下终板相互位置关系、假体轴线与原来椎间隙轴线关系,二者差距大于 2 mm 者视为不一。置换节段活动度:分别测量过屈、过伸位置置换节段上下终板平行线间夹角,两个测量值取绝对值后相加即为置换节段活动度。异位骨化和假体融合情况:依据 McAfee 等^[2]的标准,将术后椎体前缘或后缘异位骨化分为 5 级,0 级无异位骨化,Ⅰ级未侵入椎间隙,Ⅱ级侵入椎间隙但不影响假体活动度,Ⅲ级影响假体活动度,Ⅳ级关节融合。每

3 个月定期复查颈椎正侧位片,观察假体前后缘有无异位骨化或假体融合。

1.3.2 疗效评价 Odom's 标准评分^[3]:末次随访时进行,与术前评估结果对比。优,所有术前症状均消失,可以进行日常活动,无功能障碍;良,术前症状明显减轻,可以没有明显障碍进行日常活动;一般,术前症状部分减轻,但运动明显受限;差,症状无改变或者加剧。JOA 评分^[5]:采用日本骨科学会 JOA 评分法,术前和术后 24 个月分别评分。JOA 评分改善率=[(治疗后评分-治疗前评分)/(17-治疗前评分)]×100%。改善率≥85%为优,60%~84%为良,25%~59%为中,0%~24%为差。颈椎残障功能量表^[4](neck disability index, NDI)评价术后临床症状改善和日常功能状态。

1.3.3 统计学处理 采用 SPSS 10.0 软件包对手术前后颈椎前屈后伸和左右侧屈活动范围,以及 JOA 和 NDI 评分行配对资料 *t* 检验,*P*<0.05 为差异有统计学意义。

2 结果

2.1 X 线观察结果 末次随访时均未发现假体松动、下沉等现象。假体尺寸选择合适,无假体相对于椎体偏大或偏小,假体上下终板相互位置关系良好。前屈后伸活动范围术前(5.6±1.5)°,术后(8.5±1.8)°,手术前后差异有统计学意义(*P*<0.001)。左右侧屈活动范围术前分别为(2.6±0.5)°和(2.7±0.6)°,术后分别为(3.5±1.2)°和(3.3±1.5)°,手术前后差异有统计学意义(*P*<0.001)。末次随访时 X 线显示 34 例假体上下终板保持良好活动;3 例出现异位骨化,2 例为Ⅱ度异位骨化,1 例为Ⅲ度异位骨化,1 例发生于术后 6 个月,2 例出现于术后 24 个月;2 例出现假体融合,1 例发生于术后 6 个月,1 例出现于术后 24 个月。其中 1 例假体融合病例置换节段前后活动范围 0°~0.6°,左右侧屈范围 0°~0.8°,几乎丧失活动度(典型病例见图 1-2)。

2.2 疗效观察 患者术后神经功能改善明显,以神经根性症状为主患者,上肢放射痛全部缓解。Odom's 评估结果:优 25 例,良 9 例,一般 5 例。JOA 评分结果见表 1,手术前后比较差异有统计学意义(*P*<0.01)。NDI 评分术前(43.7±3.8)分,术后 1 个月随访(32.2±5.1)分,末次随访降至(20.1±2.9)分,与术前比较差异有统计学意义(*P*<0.05)。

3 讨论

3.1 颈椎间盘置换术后异位骨化发生概况 国内人工颈椎间盘置换术开展略迟于国外,目前国内相关报道多为短期临床资料且缺乏长期临床随访。2005 年初,我科在国内同步开展 Bryan 人工颈椎间

表 1 39 颈椎间盘突出症患者手术前后 JOA 评分结果 (x±s, 分)

Tab.1 JOA score of 39 patients with cervical disc herniation before and after operation (x±s, score)

项目	术前	术后 1 个月	末次随访
上肢运动功能	1.81±0.92	3.32±0.61	3.36±0.37
下肢运动功能	1.65±0.75	3.11±0.85	3.73±0.15
上肢感觉	1.22±0.43	1.25±0.76	1.78±0.21
下肢感觉	1.31±0.51	1.35±0.21	1.61±0.33
躯干感觉	1.04±0.32	1.78±0.15	1.81±0.87
膀胱功能	1.23±0.73	2.36±0.93	3.42±1.89
总分	8.26±1.32	13.17±2.15*	15.71±1.89**

注:与术前比较, *t=12.031, P=0.000; **t=13.097, P=0.000

Note: Compared with preoperative data, *t=12.031, P=0.000; **t=13.097, P=0.000



图 1 患者,男,55 岁,颈椎间盘突出症 1a. 术前 MRI 检查提示 C_{4,5} 椎间盘突出压迫脊髓 1b. 人工颈椎间盘置换术后 6 个月复查 CT 提示椎体后缘发生异位骨化

Fig.1 A 55-year-old male patient with cervical disc herniation 1a. Pre-operative MRI showed cervical disc herniation of C_{4,5} level and spinal cord compressed 1b. CT showed heterotopic ossification in posterior border of vertebrae at the 6th month after cervical disc replacement



图 2 患者,男,48 岁,颈椎间盘突出症 2a. 术前 MRI 检查提示 C_{4,5} 和 C_{5,6} 椎间盘突出压迫脊髓 2b. 人工颈椎间盘置换术后 24 个月复查 X 线提示椎体前缘假体融合

Fig.2 A 48-year-old male patient with cervical disc herniation 2a. Preoperative MRI showed cervical disc herniation of C_{4,5} and C_{5,6} levels and spinal cord compressed 2b. CT showed heterotopic ossification in posterior border of vertebrae at the 6th month after cervical disc replacement

盘置换术,本组单节段置换 35 例,双节段置换 4 例,术后 Odom's 评分优良率达到 87.2%,JOA 评分明显增加且 NDI 评分明显降低,结果表明患者临床症状、神经功能和日常生活等明显改善,提示人工颈椎间盘置换术具有良好的早中期临床疗效。术后末次随访,2 例发生 II 度异位骨化,1 例出现 III 度异位骨化,2 例发生假体融合。从出现异位骨化到完全性自发融合,该并发症的进程和时间尚需继续观察和随访。除 1 例患者假体完全性融合外,本组术后假体前屈后伸活动范围(8.5±1.8)°,左右侧屈活动范围分别为(3.5±1.2)°和(3.3±1.5)°,生理曲度较术前明显改善或恢复正常,提示人工颈椎间盘确实可重建颈椎生理功能。人工颈椎间盘置换术的核心是通过保留病变节段活动度而达到预防相邻节段退变目的,术后如果发生异位骨化或假体融合而导致置换节段活动度降低甚至丧失,无疑相悖于该技术目的和宗旨。Bryan 假体临床应用始于 2000 年,但直至 2005 年 Leung 等^[5]率先报道 Bryan 人工颈椎间盘置换术后假体融合病例。Mehren 等^[6]对 22 个 Bryan 假体置换节段术后随访 3 年,结果发现 18 个节段出现异位骨化和假体融合,发生率达 76%。Ren 等^[7]对 61 个 Bryan 假体置换节段随访 2 年,结果表明 19 个节段发生异位骨化,8 个节段发生假体融合,合计 43% 的发生率。Tortolani 等^[8]随访 98 例 Bryan 假体置换术后患者,异位骨化发生率 22%,6.5% 的患者出现 III-IV 度异位骨化。然而,Richards 等^[9]对 78 例 Bryan 假体置换患者术后随访 4 年,仅 2 例出现异位骨化和假体融合,发生率只有 3%。综上所述,颈椎间盘置换术后异位骨化发生率相关报道差异很大,其结果除与病例数或随访周期有关外,可能与手术技巧或围手术期处理密切相关。

3.2 颈椎间盘置换术后异位骨化的预防 目前人工颈椎间盘置换术后异位骨化发生机制尚不明确,以往多采用非甾体消炎镇痛药物预防异位骨化,有关人工颈椎间盘置换术预防异位骨化发生的文献报道极少。Wu 等^[10]的研究发现男性和老年患者更易发生异位骨化,结果与全髋关节置换术和脊髓损伤后异位骨化相关研究相同。Du 等^[11]认为 Bryan 人工椎间盘置换术中使用牵开器牵拉双侧颈长肌,造成颈长肌损伤和炎症反应,可能是术后异位骨化发生的启动因素之一。Tu 等^[12]的研究认为 Bryan 假体置换术中需要对椎体终板打磨,术中骨碎屑和残渣如果没有彻底冲洗清理而残留在椎间隙后方可能是诱发异位骨化的另一个原因。周非非等^[13]通过 Logistic 回归分析发现术前病变节段椎间隙高度丢失过多是异位骨化的危险因素,术前椎间隙高度丢失大于 20%

则术后易发生异位骨化。此外,异位骨化的发生率与该技术学习曲线有明显关系,异位骨化多发生于该项技术开展早期。Coric 等^[14]报告早期接受 Bryan 假体置换术 10 例患者 5 例术后随访 6 年发生异位骨化,发生率为 50%。随着手术操作经验积累,Coric 对 2 年后接受单节段 Bryan 假体置换术 69 例患者术后随访 4 年,结果 16 例发生异位骨化,发生率降低至 23.2%。人工颈椎间盘置换术是对操作技巧要求较高的手术,随着对该手术熟练程度掌握的不断深入,异位骨化发生率也逐步下降。Goffin 等^[15]的研究发现术后外固定时间长短与异位骨化和假体融合的发生率密切相关,若术后减少外固定使用时间甚至不使用,早期功能锻炼可预防早期异位骨化和假体融合。笔者认为:规范的手术操作对预防异位骨化的发生可能更为有效,椎管减压时不仅应彻底切除椎体后缘增生骨赘,同时还应该完全切除增生肥厚的后纵韧带。后纵韧带在异位骨化形成过程中可能类似支架的诱导作用,切除增生肥厚的后纵韧带可消除其负面效应^[16]。术中应尽可能选择最合适的人工假体植入,这样假体金属终板与椎体骨性终板接触包容面积最大,在维持颈椎术后即刻稳定性的同时,可最大限度撑开椎间隙后方并有效避免椎体后缘骨性接触。

参考文献

- [1] Tu TH, Wu JC, Huang WC, et al. The effects of carpentry on heterotopic ossification and mobility in cervical arthroplasty: determination by computed tomography with a minimum 2-year follow-up: Clinical article[J]. J Neurosurg Spine, 2012, 16(6): 601-609.
- [2] McAfee PC, Cappuccino A, Cunningham BW, et al. Lower incidence of dysphagia with cervical arthroplasty compared with ACDF in a prospective randomized clinical trial[J]. J Spinal Disord Tech, 2010, 23(1): 1-8.
- [3] Yagi M, Ninomiya K, Kihara M, et al. Long-term surgical outcome and risk factors in patients with cervical myelopathy and a change in signal intensity of intramedullary spinal cord on Magnetic Resonance imaging[J]. J Neurosurg Spine, 2010, 12(1): 59-65.
- [4] Fukui M, Chiba K, Kawakami M, et al. Japanese Orthopaedic Association Cervical Myelopathy Evaluation Questionnaire (JOACMEQ): part 4. Establishment of equations for severity scores. Subcommittee on low back pain and cervical myelopathy, evaluation of the clinical outcome committee of the Japanese Orthopaedic Association[J]. J Orthop Sci, 2008, 13(1): 25-31.
- [5] Leung C, Casey AT, Goffin J, et al. Clinical significance of heterotopic ossification in cervical disc replacement: a prospective multi-center clinical trial[J]. Neurosurgery, 2005, 57(4): 759-763.
- [6] Mehren C, Suchomel P, Grochulla F, et al. Heterotopic ossification in total cervical artificial disc replacement[J]. Spine (Phila Pa 1976), 2006, 31(24): 2802-2806.
- [7] Ren X, Wang W, Chu T, et al. The intermediate clinical outcome and its limitations of Bryan cervical arthroplasty for treatment of cervical disc herniation[J]. J Spinal Disord Tech, 2011, 24(4): 221-229.
- [8] Tortolani PJ, Cunningham BW, Eng M, et al. Prevalence of heterotopic ossification following total disc replacement. A prospective, randomized study of two hundred and seventy-six patients[J]. J Bone Joint Surg Am, 2007, 89(1): 82-88.
- [9] Richards O, Choi D, Timothy J. Cervical arthroplasty: the beginning, the middle, the end [J]. Br J Neurosurg, 2012, 26(1): 2-6.
- [10] Wu JC, Huang WC, Tu TH, et al. Differences between soft-disc herniation and spondylosis in cervical arthroplasty: CT-documented heterotopic ossification with minimum 2 years of follow-up[J]. J Neurosurg Spine, 2012, 16(2): 163-171.
- [11] Du J, Li M, Liu H, et al. Early follow-up outcomes after treatment of degenerative disc disease with the discover cervical disc prosthesis[J]. Spine J, 2011, 11(4): 281-289.
- [12] Tu TH, Wu JC, Huang WC, et al. Heterotopic ossification after cervical total disc replacement: determination by CT and effects on clinical outcomes[J]. J Neurosurg Spine, 2011, 14(4): 457-465.
- [13] 周非非, 赵衍斌, 孙宇, 等. Bryan 人工颈椎间盘置换术后异位骨化形成的临床因素分析[J]. 中国脊柱脊髓杂志, 2009, 19(4): 39-43.
Zhou FF, Zhao YB, Sun Y, et al. Preliminary study of surgical outcome assessment system of cervical spondylosis[J]. Zhongguo Ji Zhu Ji Sui Za Zhi, 2009, 19(4): 39-43. Chinese.
- [14] Coric D, Cassis J, Carew JD, et al. Prospective study of cervical arthroplasty in 98 patients involved in 1 of 3 separate investigational device exemption studies from a single investigational site with a minimum 2-year follow-up[J]. J Neurosurg Spine, 2010, 13(6): 715-721.
- [15] Goffin J, Casey A, Kehr P, et al. Preliminary clinical experience with the Bryan cervical disc prosthesis[J]. Neurosurgery, 2002, 51(3): 840-845.
- [16] 周雷杰, 陆继业, 徐荣明, 等. 人工颈椎间盘置换术后中期并发症的临床观察[J]. 中国骨伤, 2010, 23(7): 514-517.
Zhou LJ, Lu JY, Xu RM, et al. Clinical observation of mid stage complications after cervical disc replacement[J]. Zhongguo Gu Shang/China J Orthop Trauma, 2010, 23(7): 514-517. Chinese with abstract in English.

(收稿日期: 2012-11-19 本文编辑: 王宏)