

临床论著

颈椎后纵韧带骨化与椎间盘突出合并无骨折脱位
颈脊髓损伤的手术疗效比较

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【摘要】目的:探讨颈椎后纵韧带骨化(ossification of posterior longitudinal ligament, OPLL)或颈椎间盘突出合并无骨折脱位颈脊髓损伤患者手术治疗的效果及其差异性。方法:回顾性分析 2017 年 1 月~2019 年 12 月我科收治的无骨折脱位颈脊髓损伤并经手术治疗患者,选取其中 35 例 3 个节段及以上 OPLL 或者颈椎间盘突出患者纳入本研究。其中男性 19 例,女性 16 例。根据术前 MRI 及 CT 影像学特点将患者分为 OPLL 组(A 组 18 例)与颈椎间盘突出组(B 组 17 例),两组间年龄及性别无统计学差异($P>0.05$)。手术方式均为颈椎后路椎管扩大成形术。记录两组患者术前及术后 1 周、3 个月、6 个月的 mJOA 评分及 ASIA 分级,计算并比较 mJOA 评分改善率和 ASIA 分级改善值。结果:A 组手术时间为 $95\pm 12\text{min}$, B 组为 $95\pm 15\text{min}$ ($P>0.05$); A 组术中出血量为 $450\pm 55\text{ml}$, B 组为 $440\pm 60\text{ml}$ ($P>0.05$); A 组住院时间为 $10.5\pm 1.3\text{d}$, B 组为 $10.2\pm 1.4\text{d}$ ($P>0.05$)。随访期间两组患者均未出现严重并发症。A 组术前、术后 1 周、术后 3 个月、术后 6 个月 mJOA 评分分别为 5.2 ± 5.6 分、 7.1 ± 4.3 分、 8.6 ± 3.7 分、 12.9 ± 3.8 分, B 组分别为 4.8 ± 3.8 分、 6.7 ± 4.1 分、 7.0 ± 3.8 分、 9.3 ± 3.6 分,两组间差异无统计学意义($P>0.05$)。术后 1 周两组 mJOA 评分改善率分别为 16.2% 和 14.1%, ASIA 分级改善值分别为 1.2 分和 1.0 分,两组间无统计学差异($P>0.05$); 术后 3 个月 mJOA 评分改善率分别为 26.5% 和 16.5%, ASIA 分级改善值分别为 2.3 分和 1.5 分,两组间有统计学差异($P<0.05$); 术后 6 个月 mJOA 评分改善率分别为 62.3% 和 33.6%, ASIA 分级改善值分别为 2.6 分、1.8 分,两组间有统计学差异($P<0.05$)。结论:后路椎管扩大成形术治疗无骨折脱位颈脊髓损伤能够获得满意疗效,其中合并 OPLL 患者神经功能恢复改善程度在术后 3 个月及术后 6 个月时优于合并颈椎间盘突出患者,该差异可能与脊髓致压物的性质有一定关系。

【关键词】颈脊髓损伤;颈椎后纵韧带骨化;颈椎间盘突出;椎管扩大成形术

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【Abstract】Objectives: To investigate the clinical characteristics and surgical effects of ossification of posterior longitudinal ligament(OPLL) of cervical spine and disc herniation combined with spinal cord injury without fracture and dislocation. Methods: Retrospective analysis of patients with cervical spinal cord injury without fracture and dislocation treated with posterior laminoplasty in our department from January 2017 to December 2019, 35 patients with cervical spinal cord injury without fracture and dislocation who were treated surgically were selected for this study. There were 19 males and 16 females. According to the imaging characteristics by MRI and CT, the patients were divided into cervical posterior longitudinal ligament ossification group (group A, 18 cases) and cervical disc herniation group (group B, 17 cases). The mJOA score and its improvement rate, as well as the ASIA score and ASIA score improvement value were recorded before operation, at 1 week, 3 months, and 6 months after operation. Results: In group A and group B respectively, the operation time was $95\pm 12\text{min}$ and $95\pm 15\text{min}$, the intraoperative blood loss was $450\pm 55\text{ml}$ and $440\pm 60\text{ml}$, and the length of hospital stay was $10.5\pm 1.3\text{d}$ and $10.2\pm 1.4\text{d}$. The follow-up time nodes were 1 week, 3 months and more

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than 6 months after operation. There were no serious complications in both groups. At pre-operation, 1 week, 3 months, and 6 months after operation, the mJOA scores of group A were 5.2 ± 5.6 , 7.1 ± 4.3 , 8.6 ± 3.7 , and 12.9 ± 3.8 respectively, and those in group B were 4.8 ± 3.8 , 6.7 ± 4.1 , 7.0 ± 3.8 , and 9.3 ± 3.6 respectively. There was no significant difference between the two groups ($P > 0.05$). One week after operation, the mJOA scores were 7.1 ± 4.3 in group A and 6.7 ± 4.1 in group B, and the improvement rates of mJOA scores were 16.2% and 14.1% respectively, and the improvement values of ASIA were 1.2 and 1.0 respectively. There was no significant difference between the two groups ($P > 0.05$). At 3 months after operation, the mJOA scores of group A and group B were 8.6 ± 3.7 and 7.0 ± 3.8 , and the improvement rates of mJOA scores were 26.5% and 16.5% respectively, and the improvement values of ASIA were 2.3 and 1.5 respectively. There was significant difference between the two groups ($P < 0.05$). At 6 months after operation, the mJOA scores of group A and group B were 12.9 ± 3.8 and 9.3 ± 3.6 respectively. The improvement rates of mJOA scores were 62.3% and 33.6% respectively, and the improvement values of ASIA scores were 2.6 and 1.8 respectively. There was significant difference between the two groups ($P < 0.05$). **Conclusion:** Posterior laminoplasty can achieve satisfactory results in the treatment of cervical spinal cord injury without fracture and dislocation. The improvement of neurological recovery in patients with cervical spinal cord injury combined with ossification of cervical posterior longitudinal ligament is better than that patients who combined with cervical disc herniation at 3 and 6 months after operation.

[Key words] Cervical spinal cord injury; Ossification of cervical posterior longitudinal ligament; Cervical disc herniation; Laminoplasty

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随着交通工具的多样化,颈脊髓损伤的发生率有上升趋势。颈脊髓损伤的主要类型为颈脊髓中央管周围损伤,多造成肢体功能障碍,影响患者生活质量,给社会及家庭带来沉重的负担^[1-3]。无骨折脱位型脊髓损伤也称无放射学影像异常的脊髓损伤 (spinal cord injury without radiographic abnormality, SCIWORA),是一种低能量脊髓损伤,通常经 X 线及 CT 等放射学检查无颈椎骨折或脱位等异常表现。大多数 SCIWORA 患者并非遭受车祸或高处坠落等高能暴力,而是由骑车跌倒或者车辆碰擦等低能量损伤引起^[4]。患者既往存在颈脊髓受压的病理基础,如伴多节段颈椎后纵韧带骨化(ossification of posterior vertebral longitudinal ligament, OPLL)或多节段颈椎间盘突出^[5]。由于早期并未出现明显脊髓压迫症状,未予重视或诊治,但脊髓缓冲空间已明显减少,一旦发生外伤极易造成脊髓损伤^[6]。文献报道早期脊髓减压手术治疗颈脊髓损伤是必要且有效的^[7-8]。颈椎后路椎管扩大成形术能有效扩大椎管容积、广泛脊髓减压,是目前临床治疗无骨折脱位颈脊髓损伤的常用术式^[9,10]。笔者对颈椎 OPLL 或椎间盘突出发生 SCIWORA 患者的诊疗过程中发现,二者的手术疗效存在一定的差异。为研究手术疗效差异

的原因,我们对两种基础疾病发生 SCIWORA 的患者进行手术疗效的回顾性研究。

1 资料及方法

1.1 一般资料

回顾性分析 2017 年 1 月~2019 年 12 月我科收治的颈脊髓损伤患者,病例纳入标准:(1)有导致颈脊髓急性损伤的外伤史;(2)受伤前无明显神经症状;(3)查体患者四肢或躯干感觉障碍和/或运动障碍,符合颈脊髓损伤后截瘫或四肢不全瘫;(4)颈椎 MRI 或 CT 可见明显颈椎管狭窄、多节段颈脊髓压迫,致压物为突出的椎间盘或骨化的后纵韧带;(5)无颈椎不稳定且颈椎 CT 影像评价骨化物未超过 C2~C7 椎管中点连线,即 K-line 阳性者。排除标准:(1)存在颈椎骨折脱位或颈椎节段不稳定者;(2)合并有其他神经系统疾病者。

共纳入患者 35 例,其中男性 19 例,年龄 42~68 岁,平均 56.4 ± 7.6 岁;女性 16 例,年龄 46~69 岁,平均 58.2 ± 6.4 岁。根据患者 MRI 及 CT 影像学结果,将脊髓致压物为多节段 OPLL 者纳入 OPLL 组(A 组,18 例);将脊髓致压物为单纯多节段椎间盘组织纳入颈椎间盘突出组(B 组,17 例),两组间患者性别及年龄分布差异无统计学意义($P >$

0.05)。所有患者均择期行颈椎后路椎管扩大成形术,手术由同一手术团队操作。

1.2 手术方法

患者全身麻醉后俯卧位固定于石膏床上,颈部呈自然放松。取颈后正中切口切开皮肤,显露 C3~C7 皮下筋膜。沿棘突两侧骨膜以电刀分离肌肉,充分显露 C3~C7 双侧椎板及侧块内缘。在右侧 C3~C7 椎板侧块交界处内缘 2mm 使用磨钻或咬骨钳咬除表层骨皮质开槽作为门轴;以左侧 C3~C7 椎板侧块交界处内缘 2mm 使用咬骨钳咬除表层骨皮质开槽,并使用高速磨钻沿开槽路径磨至深部骨皮质,2mm 超薄枪钳咬断深部骨皮质,离断的椎板与侧块侧作为开门侧。椎板掀开器自 C3 右侧椎板外缘为门轴掀开椎板宽度为 8mm,使用 8 号 Arch 椎板成形系统(强生,美国)固定开门;C4~C7 门轴掀开椎板宽度为 10mm,并使用相应 Arch 椎板成形系统固定开门。仔细止血并使用生理盐水冲洗创口,逐层缝合,无菌敷料包扎。围手术期嘱患者咳嗽、深呼吸训练,手术后常规给予抗炎、止痛、脱水、神经营养等对症治疗 3~5d,术后 72h 视伤口引流量适时拔除引流管,术后 5~7d 转康复医院行高压氧等康复治疗。

1.3 观察指标

患者随访时间>6 个月。记录两组患者术前及术后 1 周、3 个月、6 个月 mJOA 评分及 ASIA 分级情况,计算 mJOA 评分改善率和 ASIA 分级改善值,mJOA 评分改善率=(术后 mJOA 评分-术前 mJOA 评分)/(18-术前 mJOA 评分)×100%,ASIA 分级改善值计算方法见表 1。术后定期复查,行颈椎 X 线片、CT 及 MRI 检查。记录两组患者脊髓压迫节段数、脊髓压迫节段 Pavlov 比值、脊髓高信号改变节段数以及信号改变节段与脊髓压迫节段比值。

1.4 统计学处理

采用 SPSS 19.0 软件对数据进行统计学处理,计量资料用 $\bar{x} \pm s$ 表示,对连续变量进行正态性

检验,统计学分析服从正态分布,组间比较采用独立样本 t 检验,计数资料的比较采用 χ^2 检验; $P < 0.05$ 为差异有统计学意义。

2 结果

术前一般资料及影像学资料见表 2,A 组的典型病例见图 1。两组术前脊髓压迫节段椎管 Pavlov 比值差异有统计学意义 ($P < 0.05$),A 组侵占椎管容积较 B 组更为明显。A 组术前脊髓高信号改变的范围与骨化物涉及节段比值为 0.6 ± 0.2 ,B 组为 1.2 ± 0.3 ,两组间差异有统计学意义 ($P < 0.05$)。A 组术前出现脊髓信号改变患者脊髓信号改变范围比较局限或脊髓信号改变边缘对比度高(图 2);而 B 组术前出现脊髓信号改变患者脊髓信号改变特点为脊髓信号改变范围大且脊髓信号改变边缘对比度低(图 3)。

A 组患者术前脊髓信号改变比例为 33.33%,B 组患者脊髓信号改变比例为 47.06%,差异有统

表 2 两组患者一般资料及影像学资料

Table 2 Comparison of general data between both groups

	A组(n=18) Group A	B组(n=17) Group B
性别 Gender		
男 Male	10	9
女 Female	8	8
年龄(岁) Age(years)	55±5.2	54.3±6.1 ^①
术前 mJOA 评分(分) Preoperative mJOA score	5.2±5.6	4.8±3.8 ^②
脊髓信号改变数(n) Signal changes	6	9 ^②
脊髓压迫节段数(n) Spinal cord compression segments	3.2±0.5	2.2±1.1 ^①
脊髓压迫节段 Pavlov 值 Mean Pavlov value	0.52±0.1	0.81±0.2 ^②
脊髓高信号改变节段数(n) Hyperintense segments	1.6±0.8	2.2±0.9 ^②
信号改变/脊髓压迫节段比 Signal change/spinal cord compression segment ratio	0.6±0.2	1.2±0.3 ^②
住院日(d) Length of hospital stay	10.5±1.3	10.2±1.4 ^①
手术时间(min) Operation time	95±12	92±15 ^①
出血量(ml) Blood loss	450±55	440±60 ^①
术后引流量(ml) Blood discharge	205±40	210±45 ^①

注:①与 A 组比较 $P > 0.05$;②与 A 组比较 $P < 0.05$

Note: ①Compared with group A, $P > 0.05$; ②Compared with group A, $P < 0.05$

表 1 ASIA 分级改善计算方法

Table 1 ASIA grading improvement score

改善分值(分) Improvement score	ASIA 分级变化 Asia classification change
1	A→B, B→C, C→D, D→E
2	A→C, B→D, C→E
3	A→D, B→E
4	A→E

计学意义($P<0.05$)。A 组患者胸腔积液及肺炎 3 例,低钠血症 4 例;B 组患者胸腔积液及肺炎患者 3 例,低钠血症患者 5 例,均予控制后实施手术。所有患者手术均顺利。两组手术时间、术中出血量、术后引流量等无统计学差异($P>0.05$)。两组患者手术切口均 I 期愈合。两组患者术后均无脑脊液漏、C5 神经根麻痹、颈部轴性痛、褥疮等并发症,术后并发症无统计学差异($P>0.05$)。

两组术前 mJOA 评分比较无统计学差异($P>$

0.05,表 3);术后神经症状均较术前有改善,两组术后 1 周、术后 3 个月、术后 6 个月 mJOA 评分改善率及 ASIA 分级改善值变化见表 3。两组患者术后 1 周 mJOA 评分改善率及 ASIA 分级改善值变化组间比较无统计学差异($P>0.05$)。两组术后 3 个月及术后 6 个月 mJOA 评分及 ASIA 分级改善值变化组间差异有统计学意义($P<0.05$)。两组无神经功能恶化病例,均未出现严重并发症。



图 1 患者男性,50 岁,OPLL 伴颈脊髓损伤,行颈椎后路椎管扩大成形术(C3~C7) **a、b** 术前颈椎正侧位 X 线片可见颈椎序列良好 **c、d** 术前颈椎 CT 可见 C4~C7 呈混合型 OPLL **e、f** 术前颈椎 MRI 平扫示颈椎矢状位及横断面脊髓压迫明显 **g、h** 术后第 1 天颈椎正侧位 X 线片可见椎管扩大满意 **i、j** 术后 6 个月颈椎正侧位 X 线片见内固定位置无移位,椎管扩大成形形态良好

Figure 1 Male patient, 50 years old, OPLL with cervical spinal cord injury, underwent posterior cervical laminoplasty (C3~C7) **a, b** X-ray film of anteroposterior and lateral position of cervical spine before operation

showed that the cervical spine sequence was good **c, d** Preoperative cervical CT showed that C4~C7 was a mixed OPLL **e, f** Preoperative MRI of cervical spine showed obvious spinal cord compression in sagittal and cross-section of cervical spine **g, h** Anteroposterior and lateral position X-ray films of cervical spine on the first day after operation showed that the enlargement of spinal canal was satisfactory **i, j** Anteroposterior and lateral position films of cervical spine 6 months after operation showed no displacement of the internal fixation and the spinal canal expansion in a good shape

3 讨论

3.1 SCIWORA 手术疗效的影响因素

SCIWORA 由 Pang 及 Wilberger 在 1982 年总结报道,临床上并不罕见^[4]。采用减压手术治疗效果较好,但患者个体间的疗效仍存在差异^[12,13]。出现这种差异主要原因有以下方面:(1)颈脊髓损伤后患者的不全瘫状态,即患者感觉运动障碍平面的高低,平面高者手术效果差,平面低者手术效果好;(2)患者是否合并糖尿病等基础疾病,血糖控

制不佳明显影响脊髓损伤的神经恢复;(3)脊髓损伤的手术时机,早期学者认为颈脊髓损伤后可先行保守治疗,待脊髓水肿消退后再行手术治疗,这期间药物脱水治疗时间可达 1 个月左右,但近年来更多的学者认为脊髓损伤后在满足病情稳定、排除相应手术禁忌证后应尽早手术治疗,更早的手术减压可能获得更好的康复预后^[14-17];(4)脊髓减压的程度,彻底的减压更有利于脊髓功能的恢复^[18]。



图 2 患者男性,68 岁,颈脊髓损伤伴四肢不全瘫(A 组) **a、b** 术前颈椎正侧位 X 线片示颈椎序列良好 **c** 术前颈椎 CT 矢状位及骨化节段 Pavlov 参数测量 **d** 术前颈椎 MRI 平扫矢状位颈椎脊髓受压明显,受压节段为 C2~C6,脊髓高信号改变不明显 **图 3** 患者男性,60 岁,颈椎间盘突出伴颈脊髓损伤(B 组) **a、b** 术前颈椎正侧位 X 线片示颈椎序列存在 **c** 术前颈椎 CT 横断面及椎管 Pavlov 参数测量 **d** 术前颈椎 MRI 平扫矢状位见颈椎间盘突出节段为 C3~C6,脊髓信号改变范围为矢状位 C2~C6 平面

Figure 2 A male patient, 68 years old, OPLL with cervical spinal cord injury **a, b** X-ray film of anteroposterior and lateral position of cervical spine before operation showed that the cervical spine had a good sequence **c** Measurement of Pavlov parameters of cervical spine CT sagittal position and ossified segment before operation **d** Before operation, the cervical spinal cord was obviously compressed in the sagittal position of cervical MRI, the compressed segment was C2~C6, and the change of spinal cord high signal was not obvious **Figure 3** A male patient, 60 years old, cervical disc herniation with cervical spinal cord injury **a, b** X-ray film of anteroposterior and lateral position of cervical spine before operation showed that the cervical spine sequence exists **c** Preoperative CT cross section of cervical spine and Pavlov parameter measurement of spinal canal **d** Plain MRI scan of cervical spine before operation showed that the cervical disc herniation segment was C3~C6 in sagittal position, and the change range of spinal cord signal was C2~C6 in sagittal position

3.2 伴颈椎 OPLL 与多节段椎间盘突出 的 SCIWORA 手术预后差异性分析

多节段 OPLL 及颈椎间盘突出形成的椎管狭窄是一些颈脊髓损伤患者的常见基础病理状态。患者受伤前几乎无肢体功能异常,在低能量损伤后突发肢体感觉运动功能障碍,表现为急性颈脊髓损伤。此种损伤椎管有效容积减小,脊髓存在持续压迫,学者多主张采取脊髓减压手术。颈椎后路椎管扩大成形术能有效增大椎管容积,缓解脊髓水肿,相对于颈椎前方入路脊髓减压手术操作难度较小,学习曲线较为平缓,是国内外较为成熟的颈椎减压术式之一^[19,20]。本研究发现,同样接受颈椎后路椎管扩大成形术治疗,合并 OPLL 患者与合并颈椎间盘突出患者颈脊髓损伤后的恢复程度存在一定的差异,该差异表现为 OPLL 患者脊髓损伤后神经功能恢复程度更高。本研究显示,急性颈脊髓损伤合并 OPLL 症患者神经功能改善率优于颈脊髓损伤合并颈椎间盘突出患者,差异具有统计学意义。

笔者认为,合并 OPLL 患者脊髓损伤后恢复

表 3 患者术后 mJOA 评分、ASIA 分级改善情况

Table 3 Improvemens of mJOA score and ASIA grade after operation

	A组 (n=18) Group A	B组 (n=17) Group B
术后 1 周 1 week after operation		
mJOA 评分(分) mJOA score	7.1±4.3	6.7±4.1 ^①
mJOA 评分改善率(%) mJOA improvement rate	16.2%	14.1% ^①
ASIA 改善值 ASIA improvement value	1.2	1.0 ^①
术后 3 个月 3 months after operation		
mJOA 评分(分) mJOA score	8.6±3.7	7.0±3.8 ^②
mJOA 评分改善率(%) mJOA improvement rate	26.5%	16.5% ^②
ASIA 改善值 ASIA improvement value	2.3	1.5 ^②
术后 6 个月 6 months after operation		
mJOA 评分(分) mJOA score	12.9±3.8	9.3±3.6 ^②
mJOA 评分改善率(%) mJOA improvement rate	62.3%	33.6% ^②
ASIA 改善值 ASIA improvement value	2.6	1.8 ^②

注:①与 A 组比较 $P>0.05$;②与 A 组比较 $P<0.05$

Note: ①Compared with group A, $P>0.05$; ②Compared with group A, $P<0.05$

程度高的原因可能与脊髓损伤瞬间致压物压迫脊髓的位移程度、范围有关。OPLL 多表现为椎体后壁间借骨化物形成椎体间骨桥,由于该骨桥附着在椎体周围等结构上,在相同的外力损伤时颈椎局部瞬间角位移程度较小,表现为骨化物和椎体、脊髓整体进退状态,脊髓损伤后脊髓信号改变发生率低且范围局限。与合并多节段颈椎间盘突出相比,由于脊髓被单个或多个突出的颈椎间盘压迫,脊髓的受压呈多点分布,且颈椎过伸或屈曲损伤时椎体间相对位移或成角较大,脊髓瞬时受压点压强较大,脊髓损伤更重,脊髓损伤后脊髓信号改变更明显,且信号改变呈弥漫性,范围较大。这种临床特点可能与临床所表现的神经功能恢复更慢,最终肢体功能恢复程度更低有关。

3.3 脊髓信号改变对脊髓损伤的意义

有学者对脊髓型颈椎病手术疗效的研究发现,脊髓信号改变会降低颈椎术后神经功能恢复程度^[21,22]。笔者统计发现,与脊髓型颈椎病相比,颈椎脊髓损伤患者脊髓信号改变发生率较高,并且急性颈脊髓损伤后的脊髓信号改变与慢性颈椎间盘突出所致的脊髓信号改变特点也有不同。

脊髓型颈椎病椎间盘突出因素多为退变性,突出的椎间盘长期压迫脊髓所致的慢性脊髓损伤脊髓信号改变多为局灶性,其 MRI T2 加权像呈高信号改变。急性颈脊髓损伤多数患者颈椎 MRI T2 加权像脊髓呈现弥漫性高信号改变,边界不甚明显且超出椎间盘突出节段范围。

在本研究中,多节段 OPLL 组患者的颈脊髓信号改变相比多节段颈椎间盘突出组患者颈脊髓信号改变范围更为局限,且 T2 加权像高信号改变范围小于脊髓受骨化物压迫范围。目前研究无法明确脊髓信号改变与脊髓损伤和患者功能恢复程度之间存在何种关系,且脊髓信号改变的具体机制仍不甚清楚。有报道认为脊髓信号改变与患者神经功能恢复无明显相关性^[23],但更多的学者认为脊髓信号改变范围大小与颈脊髓损伤患者的神经功能恢复效果呈负相关^[24-26]。

总之,颈脊髓损伤预后主要取决于患者受伤瞬间的脊髓损伤程度^[27],其次患者脊髓减压时间窗口、充分减压的术式、围手术期甲强龙等药物治疗、术后高压氧康复治疗以及功能锻炼等康复治疗都对肢体神经功能的康复有正向作用^[7,28]。我们应该清楚,即使患者脊髓损伤结果已成定局,但是

我们仍需注意治疗前对患者脊髓损伤程度有更进一步预判。比如明确了脊髓致压物是硬性的骨化物或者软性椎间盘, 能为我们提供预估患者术后康复状态及方便与患者及家属更好地沟通。

4 参考文献

1. Koyanagi I, Iwasaki Y, Hida K, et al. Acute cervical cord injury without fracture or dislocation of the spinal column [J]. J Neurosurg, 2000, 93(1): 15–20.
2. 叶晓健, 贾连顺, 李家顺, 等. 颈椎脊髓损伤与脊髓复苏[J]. 中国脊柱脊髓杂志, 1999, 9(5): 17.
3. 刘趁心, 孟冰, 杨照, 等. 急性重度颈脊髓损伤患者临床特征分析及远期死亡危险因素初探[J]. 中国脊柱脊髓杂志, 2019, 29(3): 247–253.
4. Pang D, Wilberger Jr JE. Spinal cord injury without radiographic abnormalities in children[J]. J Neurosurg, 1982, 69(2): 177.
5. Chen TY, Dickman CA, Eleraky M, et al. The role of decompression for acute incomplete cervical spinal cord injury in cervical spondylosis[J]. Spine, 1998, 23(22): 2398–2403.
6. Vaccaro AR, Daugherty RJ, Sheehan TP, et al. Neurologic outcome of early versus late surgery for cervical spinal cord injury[J]. Spine, 1997, 22(22): 2609–2613.
7. Fehlings MG, Vaccaro A, Wilson JR, et al. Early versus delayed decompression for traumatic cervical spinal cord injury: results of the surgical timing in acute spinal cord injury study(STASCIS)[J]. PLoS One, 2012, 7(2): e32037.
8. Chen LF, Tu TH, Chen YC, et al. Risk of spinal cord injury in patients with cervical spondylotic myelopathy and ossification of posterior longitudinal ligament: a national cohort study [J]. Neurosurg Focus, 2016, 40(6): E4.
9. Yukoh O, Junichi M, Hiroshi N, et al. Cervical spinal cord injury associated with OPLL[J]. Spinal Surgery, 2005, 19(2): 111–117.
10. Hirabayashi K, Satomi K. Operative procedure and results of expansive open-door laminoplasty [J]. Spine, 1988, 13(7): 870–876.
11. Benzel EC, Lancon J, Kesterson L, et al. Cervical laminectomy and dentate ligament section for cervical spondylotic myelopathy[J]. J Spinal Disord, 1991, 4(3): 286–295.
12. Song KJ, Lee KB. The prognosis of the acute cervical spinal cord injury[J]. The Journal of the Korean Orthopaedic Association, 1998, 33(3): 794.
13. Sarhan F, Saif D, Saif A. An overview of traumatic spinal cord injury: part 1: aetiology and pathophysiology[J]. British Journal of Neuroence Nursing, 2012, 8(6): 319–325.
14. Kawano O, Ueta T, Shiba K, et al. Outcome of decompression surgery for cervical spinal cord injury without bone and disc injury in patients with spinal cord compression: a multicenter prospective study [J]. Spinal Cord, 2010, 48(7): 548–553.
15. Kwok S, Cheung J. Surgical decision-making for ossification of the posterior longitudinal ligament versus other types of degenerative cervical myelopathy: anterior versus posterior approaches[J]. BMC Musculoskelet Disord, 2020, 21(1): 823.
16. Waheed AA, Hasan S, Tan LA, et al. Cervical spine pathology and treatment: a global overview[J]. J Spine Surg, 2020, 6(1): 340–350.
17. Ellaway PH, Anand P, Bergstrom EMK, et al. Towards improved clinical and physiological assessments of recovery in spinal cord injury: a clinical initiative.[J]. Spinal Cord, 2004, 42(6): 325–337.
18. Ghasemi AA, Behfar B. Outcome of laminoplasty in cervical spinal cord injury with stable spine [J]. Asian J Neurosurg, 2016, 11(3): 282–286.
19. Lee HJ, Kim HS, Nam KH, et al. Neurologic outcome of laminoplasty for acute traumatic spinal cord injury without instability[J]. Korean J Spine, 2013, 10(3): 133–137.
20. Duetzmann S, Cole T, Ratliff JK. Cervical laminoplasty developments and trends, 2003–2013: a systematic review[J]. J Neurosurg Spine, 2015, 23(1): 24–34.
21. Yasutsugu Y, Fumihiko K, Hisatake Y. MR T2 image classification in cervical compression myelopathy: predictor of surgical outcomes[J]. Spine, 2007, 32(15): 1675.
22. Takahashi M, Sakamoto Y, Miyawaki M, et al. Increased MR signal intensity secondary to chronic cervical cord compression[J]. Neuroradiology, 1987, 29(6): 550–556.
23. Morio Y, Yamamoto K, Kuranobu K, et al. Does increased signal intensity of the spinal cord on MR images due to cervical myelopathy predict prognosis[J]. Arch Orthop Trauma Surg, 1994, 113(5): 254–259.
24. Konomi T, Suda K, Ozaki M, et al. Predictive factors for irreversible motor paralysis following cervical spinal cord injury[J]. Spinal Cord, 2021, 59(5): 554–562.
25. Takahashi M, Yamashita Y, Sakamoto Y, et al. Chronic cervical cord compression: clinical significance of increased signal intensity on MR images[J]. Radiology, 1989, 173(1): 219–224.
26. Zhang YZ, Shen Y, Wang LF, et al. Magnetic resonance T2 image signal intensity ratio and clinical manifestation predict prognosis after surgical intervention for cervical spondylotic myelopathy[J]. Spine, 2010, 35(10): E396.
27. Alizadeh A, Dyck SM, Karimi-Abdolrezaee S. Traumatic spinal cord injury: an overview of pathophysiology, models and acute injury mechanisms [J]. Front Neurol, 2019, 10: 282.
28. Asamoto S, Sugiyama H, Doi H, et al. Hyperbaric oxygen (HBO) therapy for acute traumatic cervical spinal cord injury [J]. Spinal Cord, 2000, 38(9): 538–540.

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