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镍钛形状记忆合金环抱器内固定术对多发性肋骨骨折患者术后疼痛、呼吸功能及肺部感染的影响*

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摘要 目的:探讨多发性肋骨骨折患者采用镍钛形状记忆合金环抱器内固定术治疗的临床效果。**方法:**选取 2016 年 1 月-2018 年 1 月期间我院收治的 97 例多发性肋骨骨折患者。按照不同的治疗方法将患者分为对照组($n=47$)和研究组($n=50$),对照组患者给予胸部护板外固定术,研究组患者给予镍钛形状记忆合金环抱器内固定术。比较两组患者术后 7 d 的临床疗效,比较两组术前、术后 7 d 疼痛程度及呼吸功能情况,记录两组术后并发症发生情况。**结果:**研究组患者治疗后总有效率为 92.00%(46/50),高于对照组的 76.60%(36/47)($P<0.05$)。两组患者术后 7 d 视觉疼痛模拟评分量表(VAS)评分均较术前降低,且研究组低于对照组($P<0.05$)。两组患者术后 7 d 最大自主通气量占预计值百分比(MVV%)较术前升高,且研究组高于对照组($P<0.05$);两组患者术后 7 d 第 1 秒用力呼气肺活量占预计值百分比(FEV1%)比较无差异($P>0.05$)。研究组患者术后并发症总发生率 8.00%(4/50),低于对照组的 23.40%(11/47)($P<0.05$)。**结论:**多发性肋骨骨折经镍钛形状记忆合金环抱器内固定术治疗安全、有效,可明显减轻患者术后疼痛及改善呼吸功能,临床应用价值较高。

关键词:镍钛形状记忆合金环抱器;内固定术;多发性肋骨骨折;术后疼痛;呼吸功能;肺部感染

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Effect of Ni-Ti Shape Memory Alloy Embracing Internal Fixator on Postoperative Pain, Respiratory Function and Pulmonary Infection in Patients with Multiple Rib Fractures*

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ABSTRACT Objective: To investigate the clinical effect of Ni-Ti shape memory alloy embracing internal fixator in the treatment of patients with multiple rib fractures. **Methods:** A total of 97 patients with multiple rib fractures, who were admitted to Second People's Hospital of Anhui Province from January 2016 to January 2018 were selected. The patients were divided into control group ($n=47$) and study group ($n=50$) according to the different treatment methods. The control group was treated with the external fixation of the chest protective plate, and the study group was treated with Ni-Ti shape memory alloy embracing internal fixator. The clinical effects of 7d after operation were compared between the two groups, the pain and respiratory function were compared between the two groups before operation and 7 d after operation, and the occurrence of postoperative complications were recorded in the two groups. **Results:** The total effective rate[92.00% (46/50)] in the study group, which was higher than that[76.60% (36/47)] in the control group ($P<0.05$). The visual analogue pain scale (VAS) scores in the two groups 7 d after operation were lower than those before operation, and the study group was lower than the control group ($P<0.05$). The maximum voluntary ventilation percent (MVV%) 7 d after operation in the two groups was higher than that before operation, and the study group was higher than the control group ($P<0.05$). There was no significant difference in the forced expiratory vital capacity at the 1st second percent (FEV1%) 7 d after operation between the two groups ($P>0.05$). The total incidence of postoperative complications [8.00% (4/50)] in the study group was lower than that [23.40% (11/47)] in the control group ($P<0.05$). **Conclusion:** Ni-Ti shape memory alloy embracing internal fixator for multiple rib fractures is safe and effective, it can reduce the postoperative pain and improve the respiratory function of the patients, with higher clinical application value.

Key words: Ni-Ti shape memory alloy embracing device; Internal fixator; Multiple rib fractures; Postoperative pain; Respiratory function; Pulmonary infection

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前言

肋骨骨折是指由外来暴力所致的一类骨折,约占胸廓骨折

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的9成以上,临床症状主要为呼吸受限、胸部疼痛等^[12]。多发性肋骨骨折是指肋骨骨折数量 ≥ 2 条,临床症状更为严重,剧烈的疼痛引起患者机体全身应激反应,同时可引发患者异常的呼吸运动,严重时甚至可导致休克,严重威胁患者的生命健康^[14]。多发性肋骨骨折的主要治疗原则为镇痛、固定胸廓、防治并发症等,保守外固定治疗法是以往临床常用治疗法,对机体损伤较小,大部分患者均可治愈,然而该方法治疗周期长,患者疼痛感明显,加之治疗后并发症较多,严重影响患者预后^[15-17]。近年来随着外科医疗技术的发展与进步,镍钛形状记忆合金环抱器内固定术逐渐被临床所接受,镍钛形状记忆合金环抱器对骨折断端产生的钳夹力具有持续性,从而塑造良好的恢复环境,促进骨折愈合^[18]。本研究通过探讨多发性肋骨骨折患者经镍钛形状记忆合金环抱器内固定术治疗的临床疗效,以期为临床治疗提供依据。

1 资料与方法

1.1 临床资料

选取2016年1月至2018年1月于我院接受诊治的多发性肋骨骨折患者97例。纳入标准^[19]:(1)所有患者均经CT、X射线等影像学诊断确诊为肋骨骨折;(2)肋骨骨折条数 ≥ 2 条;(3)均由外伤导致;(4)患者及其家属知情同意,并签署知情同意书。排除标准:(1)伴严重肺挫裂伤所致血胸者;(2)伴有心、肝、肾等脏器功能严重障碍者;(3)合并脏器大出血者;(4)意识不清晰或存在沟通障碍者;(5)合并有严重颅脑外伤者。根据治疗方法的不同将患者分为对照组($n=47$)和研究组($n=50$),其中对照组男35例,女12例,年龄38~62岁,平均 (46.28 ± 2.48) 岁;致伤原因:交通意外31例,高处坠落5例,其他11例;其中双侧肋骨骨折9例,单侧肋骨骨折38例。研究组男42例,女8例,年龄37~65岁,平均 (47.15 ± 2.61) 岁;致伤原因:交通意外36例,高处坠落9例,其他5例;其中双侧肋骨骨折8例,单侧肋骨骨折42例。两组患者临床资料比较无差异($P>0.05$)。本研究经我院伦理委员会审核批准。

1.2 治疗方法

所选患者入院后立即完善相关检查再行治疗,给予常规基础治疗,包括止血、补液、抗感染、化痰、镇痛等。在此基础上,对照组给予胸部护板外固定术,操作如下:术前将真空包装的护板置于70℃以上软化(软化5 min),经影像学确定骨折部位,将已软化的护板置于健侧相应部位塑形,贴于骨折位置,透气

薄膜固定。研究组患者给予镍钛形状记忆合金环抱器内固定术,步骤如下:(1)患者健侧卧位,常规置入胸腔镜探查胸腔清除积血,定位肋骨骨折部位;(2)取错位明显处中心为手术切口,以暴露骨折断端,采用复位钳复位骨折断端,用于固定;(3)将镍钛合金抓握式接骨板(江苏亚华生物科技工程有限公司,型号:J4H14-60)置于氯化钠(质量浓度:0.009 g/mL,温度:0~5℃,软化5 min)溶液中,撑开其齿壁,迅速套于骨折端上方;(4)采用沾有氯化钠(质量浓度:0.009 g/mL,温度:40~50℃)溶液的纱布外敷环抱器,当环抱器自动收紧后于骨折断端处固定;(5)固定完成后,确认有无无活动性出血、复位是否满意,清点器械纱布无误,逐层关闭切口,视患者具体情况决定是否放置引流管。术后采用常规抗感染方法治疗。

1.3 观察指标

观察两组患者术后7 d临床疗效,于术前、术后7 d采用视觉疼痛模拟评分量表(Visual analogue scale, VAS)^[20]评价两组患者疼痛程度,总分0~10分,其中0分(无痛),10分(难以忍受的疼痛),分数越高,其疼痛程度越严重。于术前、术后7 d采用6200型肺功能仪(美国SensorMedics公司生产)检测两组患者的呼吸功能,包括最大自主通气量占预计值百分比(Maximum voluntary ventilation percent, MVV%)、第1秒用力呼气肺活量占预计值百分比(Forced expiratory vital capacity in the 1st second percent, FEV1%)。记录两组术后并发症发生情况。

1.4 疗效判定标准

胸片显示骨折肋骨及周边恢复,局部疼痛消失,呼吸正常(优);胸片显示两侧胸廓基本对称,局部疼痛基本消失,呼吸基本正常(良);胸片显示骨折恢复较好,局部疼痛,呼吸有所改善(一般);胸片显示骨折恢复状态不佳,局部疼痛、呼吸均未得到改善(差)。总有效率=优率+良率^[21]。

1.5 统计学方法

采用SPSS20.0进行数据分析,计数资料以率表示,行卡方检验,计量资料以均值 $\pm$ 标准差表示,行t检验。检验标准为 $\alpha=0.05$ 。

2 结果

2.1 两组患者术后7 d临床疗效比较

研究组患者治疗后总有效率为92.00%(46/50),高于对照组的76.60%(36/47)($P<0.05$);见表1。

表1 两组患者术后7 d临床疗效比较[n(%)]

Table 1 Comparison of clinical efficacy 7 d after operation between two groups [n(%)]

Groups	Excellent	Good	Common	Bad	Total effective rate
Control group($n=47$)	18(38.30)	18(38.30)	7(14.89)	4(8.51)	36(76.60)
Study group($n=50$)	29(58.00)	17(34.00)	3(6.00)	1(2.00)	46(92.00)
χ^2					4.398
P					0.036

2.2 两组患者术前、术后7 d VAS 评分比较

两组患者术前VAS评分比较无差异($P>0.05$);两组患者

术后7 d VAS评分均较术前降低,且研究组低于对照组($P<0.05$);见表2。

表 2 两组患者术前、术后 7 d VAS 评分比较($\bar{x} \pm s$, 分)Table 2 Comparison of VAS scores before operation and 7 d after operation between two groups($\bar{x} \pm s$, scores)

Groups	n	VAS	
		Before operation	7 d after operation
Control group	47	7.46 $\pm$ 0.91	4.52 $\pm$ 0.21*
Study group	50	7.53 $\pm$ 0.87	2.03 $\pm$ 0.26*
t	-	0.387	51.689
P	-	0.699	0.000

Note: compared with before operation, *P<0.05.

2.3 两组患者术前、术后 7 d 呼吸功能比较

患者术后 7 d MVV%较术前升高, 且研究组高于对照组(P<0.05); 两组患者术前 MVV%、FEV1%比较无差异(P>0.05); 两组

患者术后 7 d FEV1%比较无差异(P>0.05); 见表 3。

表 3 两组患者术前、术后 7 d 呼吸功能比较($\bar{x} \pm s$, %)Table 3 Comparison of respiratory function before operation and 7 d after operation between two groups($\bar{x} \pm s$, %)

Groups	n	MVV%		FEV1%	
		Before operation	7 d after operation	Before operation	7 d after operation
Control group	47	73.97 $\pm$ 3.36	81.36 $\pm$ 4.28*	80.38 $\pm$ 3.12	80.84 $\pm$ 2.17
Study group	50	74.05 $\pm$ 4.01	90.49 $\pm$ 3.16*	80.27 $\pm$ 4.10	80.56 $\pm$ 3.62
t	-	0.106	12.002	0.148	0.458
P	-	0.916	0.000	0.833	0.648

Note: compared with before operation, *P<0.05.

2.4 两组患者术后并发症发生情况

组的 23.40%(11/47)(P<0.05); 见表 4。

研究组患者术后并发症总发生率 8.00%(4/50), 低于对照

表 4 两组患者术后并发症发生情况[n(%)]

Table 4 Postoperative complications in the two groups[n(%)]

Groups	Pulmonary infection	Thoracic deformity	Atelectasis	Total incidence
Control group(n=47)	4(8.51)	3(6.38)	4(8.51)	11(23.40)
Study group(n=50)	1(2.00)	1(2.00)	2(4.00)	4(8.00)
χ^2				4.398
P				0.036

3 讨论

肋骨是胸廓骨性结构重要的组成成分,在胸廓完整性以及机体正常的节律性呼吸运动中发挥着重要的作用^[12-14]。肋骨骨折在生活中较为常见,约占胸部损伤的 50%,主要分为单发性骨折与多发性肋骨骨折,多数单发性骨折经保守治疗后可自行愈合,而多发性肋骨骨折经保守治疗后常出现“胸壁浮动”现象^[15,16]。通常而言,多发性肋骨骨折较单处骨折危险性更高,主要在于多发性肋骨骨折后,局部胸壁丧失肋骨支撑,发生软化现象,肋间神经受到刺激产生疼痛感^[17-19]。而当患者变换体位时,引发患者胸痛,导致患者呼吸、咳嗽障碍,呼吸道分泌物无法有效排出体外,易提高肺部感染、胸廓畸形、肺不张等并发症发生率,严重者甚至诱发急性呼吸综合征,增大患者死亡风险^[20-22]。在保守治疗多发性肋骨骨折的诸多局限性情况下,内固定

法应运而生,镍钛形状记忆合金环抱器作为内固定法迅速发展的重要产物,具有良好的组织相容性、抗腐蚀性以及低分子退变性,同时不需要通过二次手术取出^[23,24]。本研究就此展开探讨,设置对照试验,以期临床治疗多发性肋骨骨折疗法的选择提供数据参考。

本次研究结果显示,研究组治疗后总有效率高于对照组,提示相较于传统的胸部护板外固定治疗法,镍钛形状记忆合金环抱器内固定术治疗可进一步提高临床疗效。这主要是由于镍钛形状记忆合金环抱器所用材料镍钛合金抓握式接骨板是结合人体肋骨解剖学特点设计而成,低温状态下可变形展开,而正常温度下可恢复原状,此外该术式对骨的应力遮挡作用较小,可促进骨痂生长、骨折愈合,进而提高临床疗效^[25,26]。两组患者术后 7 d VAS 评分均较术前降低,且研究组低于对照组,提示镍钛形状记忆合金环抱器内固定术治疗可显著减轻患者疼

痛。这主要是由于镍钛形状记忆合金环抱器生物相容性优,易于植入人体,加之其机械强度大,具有较好的解剖复位功能,减少了手术对骨膜剥离造成的损害,对患者骨髓腔危害程度较轻,减少对肋骨周边组织的不必要损害,有效缓解机体疼痛感^[27,28]。本研究还考察了该治疗方式对患者呼吸功能的影响,结果表明,两组患者术后7 d MVV%较术前升高,且研究组高于对照组,提示该术式可较好的改善患者呼吸功能,其中MVV%常用于衡量胸廓肺组织弹性、呼吸肌力量以及气道阻力,其研究组改善效果更佳明显的原因可能为术后患者胸廓肺组织弹性得到较好的修复,继而缓解呼吸功能障碍^[29,30]。而两组术后组间FEV1%比较差异不显著,这可能是由于患者经治疗后仍处于恢复期,术后功能恢复较慢,导致FEV1%比较不明显所致。后续报道中可增加随访时间,以观察不同术式对患者预后的不同影响。同时研究组患者术后并发症总发生率低于对照组,这主要是由于内固定术术前需明确骨折位置、骨折程度,并选取最适宜的接骨板,同时该手术可使患者呼吸顺畅,促进分泌物顺利排出,避免术后并发症的发生。

综上所述,针对多发性肋骨骨折患者,相对于传统的胸部护板外固定术,镍钛形状记忆合金环抱器内固定术治疗具有更好的临床治疗效果,可明显改善患者术后呼吸功能,减轻患者疼痛感,术后并发症总发生率得到有效控制,具有一定的临床应用价值。

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