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· 临床研究 ·

记忆钛合金肋骨接骨板对多发肋骨骨折患者呼吸功能及预后的影响*

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摘要 目的:探讨记忆钛合金肋骨接骨板对多发肋骨骨折(MRF)患者呼吸功能及预后的影响。方法:将2016年1月-2018年12月六院集团胸外科收治的300例MRF患者,按照随机数字表法分为研究组(150例)和对照组(150例),分别采用记忆钛合金肋骨接骨板内固定术、环形接骨板内固定术。观察两组患者手术情况、呼吸功能及并发症的发生情况。结果:与对照组比较,研究组的机械通气时间、下床行走时间显著缩短($P<0.05$)。术后10 d,两组各肺功能指标均显著改善,研究组显著优于对照组($P<0.05$);术后3个月,研究组FVC、FEV1水平显著优于对照组($P<0.05$)。术后住院期间,研究组胸腔闭式引流时间和总并发症发生率显著低于对照组($P<0.05$)。结论:记忆钛合金肋骨接骨板内固定治疗MRF可较好实现骨折复位,促进术后恢复及近远期呼吸功能改善,减少术后并发症,改善患者预后。

关键词:记忆钛合金肋骨接骨板;环形接骨板;内固定;多发肋骨骨折;呼吸功能;预后

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Effect of Memory Titanium Alloy Rib Plate on Respiratory Function and Prognosis in Patients with Multiple Rib Fractures*

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ABSTRACT Objective: To explore clinical effect of memory titanium alloy rib plate on respiratory function and prognosis in patients with multiple rib fractures (MRF). **Methods:** From January 2016 to December 2018, 300 MRF patients admitted to the department of orthopaedics in our hospital were divided into study group (150 cases) and control group (150 cases) according to the random number table method, memory titanium alloy rib plate fixation and ring plate fixation were used respectively. The surgery situation, respiratory function and incidence of complications in the two groups were observed. **Results:** Compared with the control group, the mechanical ventilation time, walking time of the study group were significantly shortened ($P<0.05$). On the 10th days after operation, the lung function indexes of both groups were significantly improved, and the study group was significantly better than the control group ($P<0.05$). Three months after surgery, FVC and FEV1 levels in the study group were significantly higher than those in the control group ($P<0.05$). During postoperative hospitalization, the closed thoracic drainage time and total complications in the study group was significantly lower than that in the control group ($P<0.05$). **Conclusions:** Memory titanium alloy rib plate internal fixation for MRF can better achieve fracture reduction, promote postoperative recovery and short-term and long-term respiratory function improvement, reduce postoperative complications, improve the prognosis.

Key words: Memory titanium alloy rib plate; Ring plate; Internal fixation; Multiple rib fractures; Respiratory function; Prognosis

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前言

肋骨骨折是胸外科的常见创伤,约占胸部创伤的45%~75%,单发的肋骨骨折胸壁稳定性高,一般采用外固定等保守治疗,但多发性肋骨骨折(MRF),往往合并血气胸、连枷胸等严

重并发症,诱发呼吸、循环功能障碍,若治疗不当死亡率可达40%^[1-4]。手术肋骨内固定治疗MRF已达成广泛共识,随着材料科学的快速发展,记忆钛合金肋骨接骨板以其便于塑形、固定可靠、操作简单等优势,已逐渐成为MRF内固定治疗的发展趋势,但其能否改善患者的呼吸功能及相关并发症尚缺乏足够证

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据^[5-8]。本研究对 300 例 MRF 患者分别采用记忆钛合金肋骨接骨板、环形肋骨接骨板进行内固定,比较两种方法的复位效果及对呼吸功能和预后的影响。

1 资料与方法

1.1 一般资料

选择 2016 年 1 月 -2018 年 12 月期间六院集团胸外科收治的 MRF 患者,共 300 例。入组标准:(1)胸片及胸部 CT 等胸部影像学检查显示肋骨骨折断端错位明显,单侧肋骨骨折数超过 3 根;(2)年龄 18-75 岁,胸壁局部出现反常呼吸;(3)排除严

重骨质疏松、病理性骨折及合并严重基础疾病者。其中男 168 例,女 132 例;年龄 21~74 岁,平均(45.4± 6.1)岁。肋骨骨折数 3~9 根,平均(5.13± 1.62)根;胸部创伤评分(AIS-ISS 评分)9-17 分,平均(12.71± 2.78)分;合并症:气胸 227 例,肺挫裂伤 78 例,腹部损伤 55 例,胸骨骨折 21 例。将患者按随机数字表法随机分为研究组(记忆钛合金肋骨接骨板内固定)和对照组(环形接骨板内固定),各 150 例。两组患者在年龄、性别、肋骨骨折数及合并症等方面比较,差异均无统计学意义($P>0.05$)。见表 1。本研究符合《赫尔辛基宣言》,患者或家属均知情同意并签署手术同意书。

表 1 两组一般资料比较

Table 1 Comparison of general information between the two groups

Groups	N	Gender (male/female)	Age(year)	Number of fracture (piece)	AIS-ISS (score)	Complications			
						Pneumothorax	Pulmonary contusion	Abdominal injuries	Sternal fracture
Study group	150	81/69	44.94± 6.29	5.21± 1.46	12.43± 2.57	107	41	29	9
Control group	150	87/63	46.05± 5.66	5.05± 1.77	12.95± 3.05	120	37	26	12
t			1.61	0.85	1.60	3.06	0.28	0.20	0.46
P			0.109	0.394	0.111	0.08	0.599	0.654	0.497

1.2 手术方法

1.2.1 研究组 取健侧卧位(双侧骨折者采用平卧位,先固定较重一侧),患侧垫高 30°,行气管插管,静脉复合全身麻醉,常规消毒,从多根肋骨骨折居中处取适当长度切口(8~10 cm),清除凝血块,行胸部探查术,明确胸腔内是否肺部损伤及其他脏器组织损伤。切开骨折部位的软组织,剥离骨膜,暴露骨折断端,实施牵引复位,清理多余碎骨片尽量放回原位给予解剖复位。根据骨折段的宽度、外径、弧度等选择合适记忆合金肋骨接骨板(美国强生 Synthes)进行内固定。术毕逐层缝合窗口,并根据患者具体情况(如气胸、胸膜破裂)留置闭式引流管。

1.2.2 对照组 采用环形接骨板(镍钛合金环抱器)内固定术,通过环形接骨板进行固定操作,其余手术体位、麻醉方法及复位措施等操作均与研究组相同。

1.2.3 术后处理 术后常规抗感染、祛痰、补液等治疗,必要时给予镇痛处理。术后加强呼吸道管理,鼓励早期咳嗽并指导患者家属协助拍背排痰,进行深呼吸训练,鼓励早期下床活动。术后 3 d 复查胸片并视恢复情况拔除引流管。

1.2.4 术后处理 根据患者的病情严重程度、骨折类型及手术方式制定术后康复措施,评估下床活动时间。术后尽早患在床上练习翻身,进行下肢屈伸活动等长收缩训练,2 周左右拆线。病情允许,术后 2-3 周下床站立或行走。术后 10~12 周复查 X 线,当骨痂形成后,逐步行负重行走训练。

1.3 观察指标

① 比较分析研究组和对照组患者手术时间、术中失血量、机械通气时间、下地行走时间及住院时间。② 呼吸功能:采用德国床旁肺功能仪,分别于术前、术后 10 d、术后 3 个月随访测量肺活量(VC)占预计值,用力肺活量(FVC)占预计值,第一秒用力呼气容积(FEV1)占预计值,最大通气量(MVV)占预计值。测

量 3 次,取最大值。③ 预后:比较两组住院期间的肺部感染、脓胸、胸腔积液等胸部症状及并发症的发生情况。

1.4 统计学方法

应用 SPSS 17.0 软件包进行统计分析,计量资料以($\bar{x} \pm s$)表示,比较采用方差分析、配对或成组样本 t 检验,计数资料比较采用 χ^2 检验, $P<0.05$ 视为有统计学意义。

2 结果

2.1 两组各项手术指标、术后恢复情况比较

与对照组比较,研究组的机械通气时间、下床行走时间显著缩短,差异均有统计学意义($P<0.05$)。两组手术时间、术中出血量、机械通气比例比较,差异无统计学意义($P>0.05$)。见表 2。研究组手术前后影像学表现见图 1。

2.2 两组不同时间肺功能比较

术前,两组 VC、FVC、MVV、FEV1 水平比较,差异均无统计学意义($P>0.05$);术后 10d,两组各肺功能指标均显著改善,研究组显著优于对照组,差异均有统计学意义($P<0.05$)。术后 3 个月,研究组 FVC、FEV1 水平显著优于对照组,差异均有统计学意义($P<0.05$)。见表 3。

2.3 两组术后胸部症状及早期并发症比较

术后住院期间,两组肺部感染、脓胸的发生率比较,差异无统计学意义($P>0.05$)。研究组胸腔闭式引流时间和总并发症发生率显著低于对照组,差异均有统计学意义($P<0.05$)。见表 4。

3 讨论

MRF 患者由于局部胸壁失去肋骨支撑而软化,软化区可出现吸气时胸壁内陷,呼气时外突的反常呼吸运动^[9,10]。有研究数据显示,肋骨骨折数超过 4 根的死亡率约为 10%,8 根或以

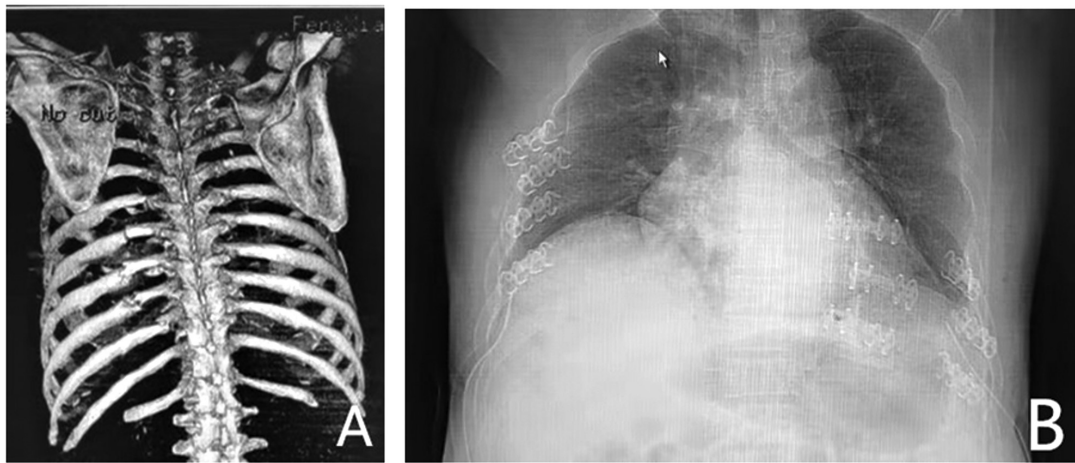
上的死亡率高达 35%,且预后不良的风险明显增加^[11-13]。稳定骨折端、恢复胸壁支撑及胸廓形态是 MRF 治疗的首要目的,以往临床上多通过通畅气道、机械通气、控制浮动胸壁、限制性液体复苏、镇痛等方式进行救治,近年来此类患者尤其是合并反常

呼吸的患者实施手术治疗已达成共识^[14,15]。肋骨属于非承重骨,对强度的要求相对不高,关键在于复位及重点区域肋骨的内固定,但若处理不当极易导致胸壁塌陷,影响肺复张,严重者可导致急性呼吸衰竭^[16-18]。

表 2 两组各项手术指标、术后恢复情况比较

Table 2 Comparison of various surgical indicators and postoperative recovery between the two groups

Groups	N	Operation time(min)	Intraoperative blood loss(mL)	Mechanical ventilation ratio[n(%)]	Mechanical ventilation time(d)	Walking time(d)
Study group	150	63.81± 15.56	81.34± 10.24	127(84.67)	3.65± 0.77	3.78± 0.64
Control group	150	66.75± 13.15	83.51± 16.84	122(81.33)	4.05± 0.81	4.27± 0.69
t		1.78	1.35	0.59	4.38	6.38
P		0.078	0.179	0.442	<0.001	<0.001



A:术前 CT 三维重建; B:术后 X 线。

图 1 MRF 手术前后胸部肋骨影像学表现

A: Preoperative three-dimensional CT reconstruction; B: Postoperative X-ray.

Fig.1 Imaging findings of chest ribs before and after MRF surgery

表 3 两组不同时间肺功能比较($\bar{x} \pm s, \%$)

Table 3 Comparison of lung function between the two groups at different time($\bar{x} \pm s, \%$)

Groups		VC	FVC	MVV	FEV1
Study group	Before operation	63.41± 10.31	61.98± 11.41	56.77± 13.16	60.21± 11.45
	10 days after operation	70.05± 12.37 [°]	70.67± 9.47 [°]	72.86± 12.19 [°]	73.06± 13.24 [°]
	3 months after operation	84.05± 10.46 ^{° °}	85.21± 10.43 ^{° ° °}	87.80± 14.12 ^{° °}	90.50± 15.16 ^{° ° °}
Control group	Before operation	61.28± 10.38	60.96± 10.39	54.73± 12.13	59.73± 12.13
	10 days after operation	65.74± 8.39 [°]	64.29± 8.58 [°]	62.76± 9.18 [°]	66.76± 14.18 [°]
	3 months after operation	81.71± 8.44 ^{° °}	80.28± 12.50 ^{° °}	85.28± 13.21 ^{° °}	82.70± 12.24 ^{° °}

Note: Compared with the group before operation, [°] $P < 0.05$. Compared with 10d after operation, [°] $P < 0.05$. Comparison between groups at the same time, [°] $P < 0.05$.

表 4 两组术后胸腔闭式引流时间及早期并发症比较[n(%)]

Table 4 Comparison of postoperative closed thoracic drainage time and early complications between the two groups [n(%)]

Groups	N	Closed thoracic drainage time(d)	Lung infection	Pyothorax	Total incidence(%)
Study group	150	4.91± 0.79	5(3.33)	0(0)	3.33
Control group	150	5.22± 0.88	11(7.33)	3(1.33)	9.33
χ^2		3.21	3.44	2.01	4.55
P		0.001	0.064	0.156	0.033

目前,MRF 内固定手术的内固定材料较多,主要有镍钛合金、记忆钛合金、可吸收聚合物等^[19,20]。镍钛合金环抱形肋骨接骨板较为常用,可预先成型且固定快捷,其对侧肋的固定优势尤为明显,但其也存在无法塑形、后肋固定困难等不足^[21,22]。记忆钛合金作为一种新型内固定材料,具有良好的组织相容性,且耐磨、耐腐蚀,力学强度高,术后无需取出。同时其更符合人体肋骨解剖特点、肋间组织游离少、塑形便捷,尤其适用于前肋近肋软骨处骨折、后肋肋骨角后骨折等特殊类型肋骨骨折^[23-25]。本研究结果显示,研究组机械通气时间、下床行走时间均较对照组显著缩短($P<0.05$),与景向永等^[26]研究结果基本一致,说明记忆钛合金内固定术固定效果更佳,可促进早期功能锻炼,有利于术后骨折愈合。

在呼吸功能方面,内固定术后 10 d 两组患者的各呼吸功能指标均开始显著改善,且研究组显著优于对照组($P<0.05$),术后 3 个月复查时研究组 FVC、FEV1 水平仍优于对照组($P<0.05$),由此可见,记忆钛合金肋骨接骨板在促进呼吸功能早期恢复更有优势,远期效果明显。汪方清等^[27]研究发现,镍钛合金环抱形肋骨接骨板内固定术治疗无连枷胸的 MRF 效果明显,但短期内(术后 2 周)呼吸功能改善不明显,6 个月肺功能可获明显改善,与本研究结果基本相符。虽然两组术后住院期间肺部感染、脓胸的发生率无明显差异($P>0.05$),但研究组胸腔闭式引流时间和总并发症发生率显著低于对照组($P<0.05$),表明可减少术后并发症,减轻患者痛苦,改善预后。临床实践发现,镍钛合金环抱器术中人为施压时,由于各爪内受力不同,肋骨稳定性难以得到充分保证,患者易在术后早期出现胸廓畸形愈合、呼吸困难等并发症,从而导致下地时间、撤除呼吸机时间延长,进而增加患者发生肺部感染或肺不张等的发生风险^[28-30]。

综上所述,记忆钛合金肋骨接骨板内固定治疗 MRF 是安全可行的,可较好实现骨折复位,促进术后恢复及近远期呼吸功能改善,减少术后并发症,改善患者预后。由于本研究随访时间尚短,其远期疗效及呼吸功能的影响进一步随访证实。

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