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跗骨窦入路联合 Herbert 螺钉及微创型跟骨锁定钢板治疗 Sanders II 型及 III 型跟骨骨折

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【摘要】 目的:探讨跗骨窦入路联合 Herbert 螺钉及微创型跟骨锁定钢板, 对比传统外侧“L”形切口入路联合钢板内固定治疗 Sanders II、III 型跟骨骨折的临床效果。**方法:**选取 2018 年 3 月至 2020 年 3 月收治的 110 例 Sanders II、III 型跟骨骨折患者, 男 66 例, 女 44 例, 年龄 20~72(48.82±8.03) 岁; Sanders II 型 48 例, III 型 62 例; 其中左侧 41 例, 右侧 69 例。依照手术入路方式将患者分为跗骨窦入路组和“L”形切口入路组, 每组 55 例。“L”形切口入路组采用传统外侧“L”形切口入路联合钢板内固定治疗, 跗骨窦入路组采用跗骨窦入路联合 Herbert 螺钉及微创型跟骨锁定钢板治疗。记录患者手术时间、术中出血量、住院时间、骨折愈合时间评价手术效果。采用 X 线检查患者手术前后的 Böhler 角、Gissane 角, 跟骨长度、宽度、高度, 评价手术复位情况。采用美国矫形外科足踝协会(American Orthopedic Foot and Ankle Society, AOFAS) Maryland 评分量表评估患者足功能恢复情况, 记录患者术后并发症发生情况。**结果:**所有患者随访至术后 12 个月, 跗骨窦入路组患者手术时间、住院时间均短于“L”形切口入路组($P<0.05$), 术中出血量低于“L”形切口入路组($P<0.05$); 术后 12 个月, 两组患者 Böhler 角、Gissane 角、跟骨长度和高度较术前升高($P<0.05$), 跟骨宽度较术前降低($P<0.05$); 术后 12 个月, 两组 Maryland 评分较术前升高($P<0.05$)。随访期间, 跗骨窦入路组术后并发症(切口感染、关节疼痛、软组织损伤)发生率低于“L”形切口入路组($P<0.05$)。**结论:**传统外侧“L”形切口入路与跗骨窦入路治疗 Sanders II、III 型跟骨骨折疗效均较好, 但后者能够缩短手术治疗时间, 减少并发症的发生。

【关键词】 最小侵入性外科手术; 跟骨骨折; 骨折固定术, 内
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Clinical study of sinus tarsal approach combined with Herbert screw and minimally invasive calcaneal locking plate in the treatment of Sanders II and III calcaneal fractures ZHOU Yu-bo, DONG Zhen-yu, XIANG Wen-yuan, and FANG Rui. Department of Orthopaedics, Affiliated Hospital of Traditional Chinese Medicine, Xinjiang Medical University, Wulumuqi 830000, Xinjiang, China

ABSTRACT Objective:To investigate the clinical effect of the tarsal sinus approach combined with Herbert screw and minimally invasive calcaneal locking plate compared with traditional lateral L-shaped incision approach combined with plate internal fixation in the treatment of Sanders II and III calcaneal fractures. **Methods:**Total of 110 patients with Sanders II and III calcaneal fractures admitted from March 2018 to March 2020 were selected. There were 66 males and 44 females, ranging in age from 20 to 72 years old, with an average of (48.82±8.03) years old. There were 48 Sanders II patients and 62 Sanders III patients, including 41 left calcaneal fractures and 69 right calcaneal fractures. According to the surgical approach, the patients were divided into the tarsal sinus approach group and the L-shaped incision approach group, 55 cases in each group. The L-shaped incision approach group was treated with traditional lateral L-shaped incision approach combined with internal fixation plate, while the sinus tarsal approach group was treated with tarsal sinus approach combined with Herbert screw and minimally invasive calcaneal locking plate. The operative time, intraoperative blood loss, length of hospital stay and time of fracture healing were recorded to evaluate the surgical effect. The Böhler angle, Gissane angle, calcaneal length and width of the patients before and after surgery were examined by X-ray and the surgical reduction was highly evaluated. Foot function recovery was evaluated by American Orthopedic Foot and Ankle Society (AOFAS) Maryland Scale, and postoperative complications were recorded. **Results:**All patients were followed up to 12 months after surgery, the operation time and hospitalization time of patients in the sinus tarsal approach group were shorter than those in the L-shaped incision approach group ($P<0.05$), and the amount of intraoperative blood loss was lower than that in the L-shaped incision approach group ($P<0.05$). One year after surgery, Böhler angle, Gissane angle, calcaneus length and height were increased ($P<0.05$), calcaneus width was decreased ($P<0.05$). One year after the operation, the Maryland scores of the two groups were increased ($P<0.05$). During the follow-up period, the incidence of postoperative complications (incision infection, joint pain, soft tissue injury) in the sinus tarsal approach group was lower than that in the L-shaped incision approach group ($P<0.05$). **Conclusion:**The traditional lateral L-shaped incision approach and the tarsal sinus approach are both good for the treatment of Sanders II and III calcaneal fractures, but the latter can shorten the surgical treatment time and reduce the incidence of complications.

KEYWORDS Minimal invasive surgical procedures; Calcaneus fractures; Fracture fixation, internal

Sanders II、III 型跟骨骨折是跗骨骨折中的常见类型,患者多为高能量损伤所致,临床多表现为跟骨剧烈疼痛、肿胀和瘀斑等^[1]。由于跟骨部位结构复杂,且骨折分型多样,周围软组织较少,手术复位难度较大,若治疗不当,可导致足功能障碍,严重影响患者生活质量^[2]。临床多采用传统外侧“L”形切口入路联合钢板内固定治疗,该方法视野广阔,便于操作,然而,由于该手术方式需要大范围剥离软组织,可能会破坏患者骨折端血运,引起多种术后并发症^[3]。近年来,随着对跟骨解剖结构的深入了解以及微创手术的快速发展,跟骨骨折手术治疗方式呈现多样性^[4]。其中,跗骨窦入路具有切口小、对软组织剥离少的特点,同时能够充分暴露踝关节,有助于复位操作。此外,在手术固定方面,Herbert 螺钉是一种尾端带螺纹的空心钉,具有双向加压和双向支撑的作用,与微创型跟骨锁定钢板联合使用,使骨块、钢板与螺钉形成整体,具有独立稳定的结构^[5]。然而,跗骨窦入路联合 Herbert 螺钉及微创型跟骨锁定钢板用于治疗 Sanders II、III 型跟骨骨折的具体效果尚不明确,鉴于此,本研究选取收治的 110 例 Sanders II、III 型跟骨骨折患者,探讨其治疗效果。

1 资料与方法

1.1 病例选择

纳入标准:经影像学检查确诊为 Sanders II 型及 III 型跟骨骨折;首次骨折;单侧闭合性骨折;年龄 20~72 岁。排除标准:陈旧性或病理性骨折患者;足踝关节手术史患者;手术不耐受患者;心肝肾等重要脏器严重功能障碍患者;骨质疏松症患者;骨关节炎患者;依从性差者。

1.2 临床资料

2018 年 3 月至 2020 年 3 月收治 110 例 Sanders II、III 型跟骨骨折患者,男 66 例,女 44 例;年龄 20~72(48.82±8.03)岁;Sanders II 型 48 例,III 型 62 例;左侧 41 例,右侧 69 例。分为跗骨窦入路组和“L”形切口入路组,每组 55 例。两组患者术前临床资料比较,差异无统计学意义($P>0.05$),具有可比性,见表 1。患者及家属均签署本研究知情同意书。本研究获得医院伦理委员会批准(编号:2020XE012 4-2)。

1.3 治疗方法

1.3.1 “L”形切口入路组 采用传统外侧“L”形切口入路联合钢板内固定治疗,术前对患者进行基础检查。采用腰硬联合麻醉,于足踝上 4 cm 处纵向切

口,至外踝向下约 2.5 cm 处外侧皮肤和足底皮肤相交处转弯 120°,向前达到第 5 跖骨基底近侧 1 cm。经皮肤全程切开至跟骨外侧壁,充分暴露骨折部位、跟距和跟骰关节面,恢复跟骨解剖形状。选择合适的钢板进行内固定,结合患者情况使用骨条、螺钉。术后清洗,放置引流管,逐层缝合,加压包扎。术后 3 d X 线复查解剖结构,并指导患者进行功能锻炼。

1.3.2 跗骨窦入路组 采用跗骨窦入路联合 Herbert 螺钉及微创型跟骨锁定钢板治疗,术前准备和麻醉同“L”形切口入路组,于外踝尖下 1 cm 横行切开皮肤 3~5 cm,将腓骨肌腱牵开,暴露塌陷后距关节。清除血块和游离骨块,手法挤压跟骨进行复位,由跟骨结节下方,置入 2 枚 4.5 mm Herbert 螺钉,沿跟骨轴置入 1 枚 6.5 mm Herbert 螺钉,跟骨外侧壁选用大小合适的微创型跟骨锁定钢板固定,术后操作同“L”形切口入路组。两组患者均由同一手术小组医师完成,术后随访 12 个月,定期到医院检查。

1.4 观察项目与方法

比较两组患者手术时间,术中出血量,住院时间,骨折愈合时间,Böhler 角,Gissane 角,跟骨长度、宽度和高度,足功能恢复情况及并发症的发生情况,其中术中出血量=(止血纱布重量-纱布干重)/血液浓度^[6];骨折愈合时间以 X 线片下骨折线消失为准^[7]。分别于术前和术后 12 个月采用 X 线检查,测量 Böhler 角,Gissane 角,跟骨长度、宽度、高度。于术前和术后 12 个月采用美国矫形外科足踝协会(American Orthopedic Foot and Ankle Society,AO-FAS)Maryland 评分量表进行评定,总分 100 分,分

数越高表示恢复越好^[8]。记录术后并发症包括切口感染、关节疼痛、软组织损伤等。

1.5 统计学处理

应用 SPSS 22.0 软件进行统计分析。经正态性检验,患者年龄,受伤至手术时间,手术时间,术中出血量,住院时间,骨折愈合时间,Böhler 角,Gissane 角,跟骨长度、宽度、高度,Maryland 评分等定量资料用均数±标准差($\bar{x}\pm s$)表示,组间比较采用成组设计定量资料的 *t* 检验;组内治疗前后比较采用配对设计定量资料的 *t* 检验。患者性别、骨折部位、Sanders 分型、并发症等定性资料用 χ^2 检验,若理论频数为 1~5 则需校正。以 *P*<0.05 为差异有统计学意义。

2 结果

2.1 术后一般情况比较

所有患者随访 12 个月,无失访患者。跗骨窦入路组患者手术时间、住院时间均短于“L”形切口入路组(*P*<0.05),术中出血量低于“L”形切口入路组(*P*<0.05),两组患者骨折愈合时间比较,差异无统计学意义(*P*>0.05),见表 2。

2.2 影像学指标比较

术后 12 个月,两组患者 Böhler 角、Gissane 角、跟骨长度和高度较术前均升高(*P*<0.05),两组患者宽度均降低(*P*<0.05);组间比较差异无统计学意义(*P*>0.05)。见表 3。

2.3 Maryland 评分比较

术后 12 个月,两组 Maryland 评分较术前均升高(*P*<0.05);组间比较差异无统计学意义(*P*>0.05)。见表 4。

表 1 两组 Sanders II 型及 III 型跟骨骨折患者术前临床资料比较
Tab.1 Comparison of basic data of patients with Sanders II and III calcaneal fractures between two groups

组别	例数	性别(例)		年龄($\bar{x}\pm s$,岁)	骨折部位(例)		Sanders 分型(例)		受伤至手术时间($\bar{x}\pm s$,d)
		男	女		左侧	右侧	II 型	III 型	
跗骨窦入路组	55	32	23	49.33±8.51	19	36	25	30	4.27±0.66
“L”形切口入路组	55	34	21	48.58±7.86	22	33	23	32	4.38±0.69
检验值		$\chi^2=0.152$		<i>t</i> =0.480	$\chi^2=0.350$		$\chi^2=0.148$		<i>t</i> =0.854
<i>P</i> 值		0.697		0.632	0.554		0.701		0.395

表 2 两组 Sanders II 型及 III 型跟骨骨折患者术后一般情况比较($\bar{x}\pm s$)
Tab.2 Comparison of postoperative general condition of patients with Sanders II and III calcaneal fractures between two groups($\bar{x}\pm s$)

组别	例数	手术时间(min)	术中出血量(ml)	住院时间(d)	骨折愈合时间(周)
跗骨窦入路组	55	59.85±10.56	24.96±3.83	11.86±1.65	11.74±1.48
“L”形切口入路组	55	68.23±12.18	28.74±4.22	14.45±1.93	12.06±1.71
<i>t</i> 值		3.855	4.919	7.565	1.049
<i>P</i> 值		<0.001	<0.001	<0.001	0.296

表 3 两组 Sanders II 型及 III 型跟骨骨折患者影像学指标比较($\bar{x}\pm s$)

Tab.3 Comparison of imaging indexes of patients with Sanders II and III calcaneal fractures between two groups($\bar{x}\pm s$)											
组别	例数	Böhler 角(°)		Gissane 角(°)		跟骨长度(mm)		跟骨宽度(mm)		跟骨高度(mm)	
		术前	术后 12 个月	术前	术后 12 个月	术前	术后 12 个月	术前	术后 12 个月	术前	术后 12 个月
跗骨窦入路组	55	13.25±2.16	29.73±4.93 ^a	93.52±16.48	122.74±18.56 ^a	62.38±9.97	74.13±12.51 ^a	38.93±6.50	27.42±4.63 ^a	32.18±5.07	42.13±7.15 ^a
		12.90±2.05	28.88±4.56 ^a	95.81±17.29	119.29±16.25 ^a	61.47±9.75	72.26±11.36 ^a	37.56±6.28	26.79±4.17 ^a	31.22±4.96	41.87±6.83 ^a
<i>t</i> 值		0.872	0.939	0.711	1.037	0.484	0.821	1.124	0.750	1.004	0.195
<i>P</i> 值		0.385	0.350	0.479	0.302	0.629	0.414	0.263	0.455	0.318	0.846

注:与术前比较,^a*P*<0.05
Note:Compared with preoperative,^a*P*<0.05

表 4 两组 Sanders II 型及 III 型跟骨骨折患者 Maryland 评分比较($\bar{x}\pm s$,分)

Tab.4 Comparison of Maryland scores of patients with Sanders II and III calcaneal fractures between two groups($\bar{x}\pm s$,score)			
组别	例数	术前	术后 12 个月
跗骨窦入路组	55	51.37±8.54	92.76±15.38 ^a
“L”形切口入路组	55	53.28±8.92	89.11±13.25 ^a
<i>t</i> 值		1.147	1.333
<i>P</i> 值		0.254	0.185

注:与术前比较,^a*P*<0.05
Note:Compared with preoperative,^a*P*<0.05

2.4 术后并发症发生情况比较

随访期间,跗骨窦入路组术后并发症发生低于“L”形切口入路组(校正 $\chi^2=3.911$,*P*=0.048),见表 5。

表 5 两组 Sanders II 型及 III 型跟骨骨折患者术后并发症发生情况比较(例)

Tab.5 Comparison of postoperative complications in patients with Sanders II and III calcaneal fractures between two groups(case)					
组别	例数	切口感染	关节疼痛	软组织损伤	合计
跗骨窦入路组	55	3	2	1	6
“L”形切口入路组	55	7	4	3	14
校正 χ^2 值		0.990	0.176	0.259	3.911
<i>P</i> 值		0.320	0.675	0.611	0.048

3 讨论

3.1 Sanders II、III 型跟骨骨折特点

跟骨是人体跗骨中最大的一块,外形不规则,与

跟骨结节联动,外侧面附着大量神经、肌腱、血管和韧带等多种结构,跟骨骨折后容易导致关联组织受损,增加手术治疗的难度^[9-10]。Sanders II、III 型跟骨骨折多采用手术治疗,传统外侧“L”形切口入路联合钢板内固定是一种经典的手术方案,能够充分暴露跟骨外侧壁。然而,该方法剥离的软组织范围较大,容易加大跟骨血运破坏,导致术后并发症发生率提高^[11]。随着微创手术的快速发展,跟骨骨折手术治疗效果得到明显提升,其中,经跗骨窦入路手术采用锐性分离,减少软组织损伤,降低对骨折患者血管网的损伤,同时联合 Herbert 螺钉及微创型跟骨锁定钢板固定,增强钢板固定的稳定性^[12-13]。因此,本研究探究跗骨窦入路联合 Herbert 螺钉及微创型跟骨锁定钢板治疗 Sanders II、III 型跟骨骨折的效果具有重要意义。

3.2 两种入路治疗 Sanders II、III 型跟骨骨折疗效比较

本研究结果显示,跗骨窦入路组患者手术时间、住院时间均短于“L”形切口入路组,术中出血量低于“L”形切口入路组,说明跗骨窦入路联合 Herbert 螺钉及微创型跟骨锁定钢板治疗 Sanders II、III 型跟骨骨折能够缩短治疗时间,减少术中出血量。分析原因,与传统手术方法相比,跗骨窦入路具有切口小、对跟骨周围软组织损伤小的优点,同时能够充分暴露跟骰的关节面和跟骨的关节面,手术医师可以直视下进行关节面复位,便于加入钢板,减少软组织损伤进而减轻对血运的破坏,加上手术时间缩短,减少患者术中出血量。本研究中术后 12 个月,两组患者 Böhler 角、Gissane 角、跟骨长度和高度均升高,跟骨宽度均降低,两组间比较无明显差异,且两组患者 Maryland 评分差异无统计学意义,说明跗骨窦入路在改善患者足功能方面,能够达到传统手术方法的

效果。跗骨窦入路手术避开副腓肠神经,减少软组织剥离,对周围血供影响小,有助于术后骨折的愈合^[14-15]。此外,Herbert 螺钉及微创型跟骨锁定钢板能够有效防止关节面塌陷和跟骨内翻,Herbert 螺钉双向加压和双向支撑能够维持跟骨长度,便于术后功能锻炼,微创型跟骨锁定采用一体化设计,与钉板间铆合稳定,增加跟骨负载能力^[16]。本研究中跗骨窦入路组术后并发症发生率低于“L”形切口入路组,说明跗骨窦入路联合 Herbert 螺钉及微创型跟骨锁定钢板治疗 Sanders II、III 型跟骨骨折能够减少并发症的发生。跗骨窦入路手术创伤小,一定程度上降低皮肤坏死概率,Herbert 螺钉尾端可完全埋入骨质中,避免跟腱皮肤刺激^[17]。

综上,跗骨窦入路联合 Herbert 螺钉及微创型跟骨锁定钢板用于治疗 Sanders II、III 型跟骨骨折能够缩短治疗时间,同时能够减少并发症的发生。然而,本研究病例选取较少,且随访时间有限,仍需扩大样本并延长随访时间,进一步证实跗骨窦入路联合 Herbert 螺钉及微创型跟骨锁定钢板用于治疗 Sanders II、III 型跟骨骨折的效果。

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