

保留距下关节的跟骨 V 形截骨矫形术治疗陈旧性跟骨骨折

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【摘要】 目的: 探讨保留距下关节的跟骨 V 形截骨矫形术治疗陈旧性跟骨骨折的临床疗效。方法: 回顾性分析 2014 年 3 月至 2017 年 11 月采用跟骨 V 形截骨术治疗的陈旧性跟骨骨折 18 例(18 足), 其中男 13 例(13 足), 女 5 例(5 足); 年龄 23~48(34.3±4.5) 岁; 病程 2~9(4.5±4.1) 个月。Sanders 分型: II 型 14 例, III 型 4 例。观察手术并发症, 比较术前及术后 12 个月跟骨 Böhler 角、Gissane 角、跟距高度、距骨倾斜角的变化情况; 并采用 Maryland 足部评分评估其临床疗效。结果: 14 例(14 足) 患者获得随访, 时间 13~35(21.2±4.1) 个月, 4 例患者失访。骨折愈合时间 10~15(12.4±2.1) 周。术后 1 例患者切口皮肤坏死, 未发生骨折不愈合及内固定松动或断裂等并发症。术后 12 个月距骨倾斜角、Böhler 角、Gissane 角及跟距高度 [(11.4±5.1)°、(24.7±4.3)°、(124±3.1)°、(46.1±2.8) mm] 较术前 [(9.1±2.9)°、(6.8±3.1)°、(93.4±11.7)°、(34.5±5.3) mm] 明显改善。Maryland 评分由术前的 59.21±7.21 提高至术后 12 个月的 86.34±4.14 ($t=43.1, P<0.05$); 其中优 8 例, 良 4 例, 可 1 例, 差 1 例。结论: 保留距下关节的跟骨 V 形截骨矫形术是治疗陈旧性跟骨骨折的有效方法之一, 具有保留距下关节, 纠正跟骨畸形, 改善足部外观, 缓解患足疼痛, 提高足部功能等优点。

【关键词】 跟骨; 骨折; 截骨术; 保留距下关节

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Treatment of old calcaneal fractures with calcaneus V-shape osteotomy for the subtalar joint preservation Li Ping, ZHANG Hui-wu, ZHANG Yu, XU Shan-qiang, ZHANG Wen-Ju, and WANG Yong. Sichuan Province Orthopaedics Hospital, Chengdu 610041, Sichuan, China

ABSTRACT Objective: To observe the clinical effect of calcaneus V-shape osteotomy for the subtalar joint preservation in the treatment of old calcaneal fractures. **Methods:** A retrospective study was conducted on 18 patients (18 feet) with old calcaneal fractures treated by calcaneus V-shape osteotomy from March 2014 to November 2017. Included 13 males and 5 females, aged from 23 to 48 years old with an average of (34.3±4.5) years and the course of disease was from 2 to 9 months with an average of (4.5±4.1) months. According to the classification of Sanders, 14 cases of type II and 4 cases of type III. The postoperative complications were observed. The changes of Böhler angle, Gissane angle, heel height and the tilt angle of talus were compared between before operation and 12 months after operation. Maryland foot score was used to evaluate the curative effect. **Results:** Fourteen patients were followed up, 4 patients were loss to follow-up. And the follow-up time was 13 to 35 months, with an average of (21.2±4.1) months. The fracture healing time was 10 to 12 weeks with an average of (12.4±2.1) weeks. One patient had skin necrosis of incision after operation, and no complications such as nonunion of fracture and loosening or rupture of internal fixation were found. The tilt angle of talus, Böhler angle, Gissane angle, heel height at 12 months after operation were (11.4±5.1)°, (24.7±4.3)°, (124±3.1)°, (46.1±2.8) mm, respectively, while before operation were (9.1±2.9)°, (6.8±3.1)°, (93.4±11.7)°, (34.5±5.3) mm, there were significant difference between before and after operation. Maryland score was significantly increased from 59.21±7.21 preoperatively to 86.34±4.14 postoperatively 12 months ($t=43.1, P<0.05$), and 8 cases got excellent results, 4 good, 1 fair, 1 poor. **Conclusion:** Calcaneus V-shape osteotomy for subtalar joint preservation is one of the effective methods in the treatment of old calcaneal fractures, which has the advantages of preserving subtalar joint, correcting calcaneal deformity, improving foot appearance, alleviating foot pain and raising foot function.

KEYWORDS Calcaneus; Fractures; Osteotomy; Subtalar joint preservation

跟骨骨折是最常见的跗骨骨折, 若骨折治疗不

及时或处理不当形成跟骨骨折畸形愈合将引起患足疼痛、活动明显受限, 严重影响患者的生活质量^[1]。陈旧性跟骨骨折畸形愈合目前多采用距下关节融合内定术治疗, 但该术式会造成距下关节活动丧失, 严

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重影响踝关节及距舟关节活动^[2]。Rammelt 等^[3]首次报道了保留距下关节的截骨术治疗陈旧性跟骨骨折,取得了满意的疗效。回顾性分析 2014 年 3 月至 2017 年 11 月采用保留距下关节的跟骨 V 形截骨矫形术治疗 43 例(44 足)陈旧性跟骨骨折,疗效满意,现报告如下。

1 临床资料

本组 18 例(18 足),男 13 例(13 足),女 5 例(5 足);年龄 23~48(34.3±4.5)岁;病程 2~9(4.5±4.1)个月。按 Sanders 等^[4]分型:Ⅱ型 13 例,Ⅲ型 5 例。术前常规拍摄足正侧位、跟骨轴位 X 线,跟骨 CT 扫描及三维重建,足部 MRI。术前所有病例 CT 及 MRI 显示距下关节软骨未见明显破坏,无明显关节炎表现。

2 治疗方法

2.1 手术方法

采用全身麻醉,患者取健侧卧位,大腿使用止血带。若需内侧辅助切口,采用俯卧位。取跟骨外侧扩大 L 形切口,依次切开皮肤、皮下组织,骨膜下分离外侧皮瓣。探查腓骨肌腱有无脱位,若术中发现脱位,修复腓骨上支持带。3 枚 2.0 mm 克氏针无接触保护皮瓣。用骨刀凿除增宽的跟骨外侧壁,可见塌陷的关节面骨块。V 形截骨术:找到跟骨后关节面软骨与跟骨体形成的界线,以此界线前方作为第 1 条截骨线;第 2 条截骨线为从跟骨丘部开始由外向内截至有软骨存在的最内侧部分,并与第 1 条截骨线呈 V 形相交。术中见所有病例的距下关节距骨侧关节面软骨保存完好,塌陷的关节面软骨质地、厚度正常,或仅伴有轻度骨关节炎改变。对于存在跟骨内外翻的病例,在第 2 条截骨基础上继续向内截骨,将截骨线后侧部分连同跟骨结节自载距突后下方截开。借助跟骨复位钳、后足撑开器或克氏针撑开器恢复跟骨高度,同时矫正跟骨的短缩及内外翻畸形,以 1 枚 2.0 mm 克氏针从跟骨结节穿过载距突,继续穿入距骨固定距下关节,透视跟骨侧、轴位片确定跟骨力线、高度,复位满意后以 1 枚 6.5 mm 空心钉固定跟骨轴线。再在直视下将后关节面骨块复位,这时可以距骨关节面为参考模板,复位满意后以 2 枚 1.5 mm 克氏针固定,克氏针从内侧穿出以免影响外侧钢板的放置。根据骨质缺损情况,可选择劈下的外侧壁、自体髂骨或同种异体骨植骨。最后以跟骨解剖钢板固定。最后放置引流管,关闭伤口。石膏固定于踝关节中立位。

2.2 术后处理

术后常规使用抗生素及消肿药物,抬高患肢促进下肢消肿,鼓励患者行股四头肌力量练习。术后 1 周拆除石膏,开始踝关节及距下关节内外翻功能

锻炼,3 周手术切口拆线。8~10 周开始部分负重,影像学证实跟骨骨性愈合后开始全负重行走。

3 结果

3.1 疗效评价标准

通过影像学资料观察术前及术后 12 个月跟骨 Böhler 角、Gissane 角、跟距高度、距骨倾斜角的变化情况。并采用 Maryland 评分标准^[4]评估临床疗效,满分为 100 分;其中总分 90~100 分为优,75~89 分为良,50~74 分为可,<50 分为差。

3.2 治疗结果

18 例患者中 14 例获得随访,时间 13~35(21.2±4.1)个月,4 例失访患者,其中 3 例电话号码变更失联,1 例随访期间死亡。骨折愈合时间 10~15(12.4±2.1)周。1 例患者术后 2 个月手术切口出现局部皮肤坏死,螺钉外露,取除内固定、应用真空封闭引流(vacuum sealing drainage, VSD)后伤口愈合。术后 12 个月距骨倾斜角、Böhler 角、Gissane 角及跟距高度较术前明显改善。见表 1。术后 12 个月 Maryland 评分(86.34±4.14)较术前(59.21±7.21)明显提高($t=43.1, P<0.05$);其中优 8 例,良 4 例,可 1 例,差 1 例。见表 2。典型病例见图 1, 2。

表 1 陈旧性跟骨骨折 14 例患者手术前后影像学测量指标比较($\bar{x}\pm s, ^\circ$)

Tab.1 Comparison of the imaging data of 14 patients with old calcaneal fracture before and after operation($\bar{x}\pm s, ^\circ$)

时间	Böhler 角	Gissane 角	距骨倾斜角	跟距高度 (mm)
术前	6.8±3.1	93.4±11.7	9.1±2.9	34.5±5.3
术后 12 个月	24.7±4.3	124±3.1	11.4±5.1	46.1±2.8
t 值	9.12	14.2	2.1	4.5
P 值	<0.05	<0.05	>0.05	<0.05

表 2 陈旧性跟骨骨折 14 例患者手术前后的 Maryland 评分比较($\bar{x}\pm s, 分$)

Tab.2 Comparison of Maryland score of 14 patients with old calcaneal fracture before and after operation($\bar{x}\pm s, score$)

时间	疼痛	功能	总分
术前	29.4±2.9	30.4±3.6	59.21±7.21
术后 12 个月	40.7±2.1	46.2±1.9	86.34±4.14
t 值	17.3	16.1	43.1
P 值	<0.05	<0.05	<0.05

4 讨论

4.1 跟骨截骨线的确定

显露并复位距下关节面是通过跟骨截骨来实现



图 1 女性患者,53 岁,右跟骨陈旧性骨折 3 个月 **1a**. 术前足负重侧位 X 线片示跟骨 Böhler 角、Gissane 角、距骨倾斜角变小 **1b**. 术前跟骨轴位 X 线片示跟骨体增宽、跟骨轻度内翻 **1c**. 术前跟骨 CT 示跟骨已部分愈合,跟骨关节面不平,跟骨体增宽 **1d**. 术前跟骨 MRI 示距下关节软骨未见明显退变 **1e**. 术中采用 V 形截骨,取出塌陷关节面,见关节面保留完整 **1f,1g**. 术后即刻跟骨侧位、轴位 X 线片示距下关节得到保留,跟骨外形已恢复,跟骨 Böhler 角、Gissane 角、距骨倾斜角已恢复,跟骨力线已恢复正常 **1h**. 术后即刻跟骨 CT 示距下关节面平整 **1i,1j**. 术后 14 个月跟骨轴位和侧位 X 线片示跟骨内固定已拆除,跟骨外形正常,距下关节面未见退变

Fig.1 A 53-year-old female patient with the right old calcaneal fracture for 3 months **1a**. Preoperative foot weight-bearing lateral X-ray showed the Böhler angle, Gissane angle, and the tilt angle of talus became smaller **1b**. Preoperative calcaneal axial X-ray showed the calcaneal body widening and calcaneus with mild varus **1c**. Preoperative calcaneal CT showed the calcaneus has partly healed, the articular surface of calcaneus was collapsed, the calcaneal body increased wide **1d**. Subtalar articular cartilage had no obvious degeneration by preoperative MRI **1e**. V-shaped osteotomy was used to remove the collapsed articular surface during the operation, and can see complete preservation of the articular surface **1f,1g**. Postoperative immediately lateral and axial X-rays showed the subtalar joint was reserved, calcaneal form was recovered, Böhler angle, Gissane angle and the tilt angle of talus also were recovered, the line of force of calcaneus was normal **1h**. Postoperative immediately CT showed the subtalar joint surface was flat **1i,1j**. Postoperative axial and lateral X-rays at 14 months showed the internal fixation had been removed, calcaneal form was normal, no obvious degeneration of subtalar joint surface was found



图 2 男性患者,34 岁,右跟骨陈旧性跟骨 4 个月 **2a.** 术前足侧位 X 线示跟骨高度降低,跟骨 Böhler 角、Gissane 角、距骨倾斜角变小 **2b.** 术前跟骨轴位 X 线示跟骨体增宽、跟骨轻度内翻,骨折端已有骨痂形成 **2c.** 术前跟骨 CT 示跟骨已部分愈合,跟骨关节面不平,跟骨体增宽 **2d.** 术前跟骨 MRI 示距下关节软骨未见明显退变 **2e.** 术中采用 V 形截骨,取出塌陷关节面,见关节面保留完整,因跟骨存在内翻畸形,将跟骨后侧完全截断 **2f,2g.** 术后即刻跟骨侧位、轴位 X 线片示距下关节得到保留,骨折复位可,跟骨 Böhler 角、Gissane 角、距骨倾斜角已恢复,跟骨力线已恢复正常 **2h.** 术后即刻跟骨 CT 示距下关节面平整 **2i,2j.** 术后 16 个月跟骨轴位和侧位 X 线示跟骨内固定已拆除,跟骨外形正常,距下关节面未见退变

Fig.2 A 34-year-old male patient with the right old calcaneal for 4 months **2a.** Preoperative lateral X-ray showed the calcaneal height was decreased, the Böhler angle, Gissane angle and tilt angle of talus became smaller **2b.** Preoperative axial X-ray of calcaneus showed calcaneal body widening and calcaneus with mild varus, the callus formation has been found at the fractured end **2c.** Preoperative CT showed that the calcaneus had partially healed, the articular surface of calcaneus was uneven, and the calcaneal body increased wide **2d.** Subtalar articular cartilage had no obvious degeneration by preoperative MRI **2e.** V-shaped osteotomy was used to remove the collapsed articular surface during the operation, and can see complete preservation of the articular surface. The posterior side of the calcaneus was completely truncated because of the varus deformity of the calcaneus **2f,2g.** Postoperative immediately lateral and axial X-rays showed the subtalar joint was preserved, the fracture could be reduced, Böhler angle, Gissane angle and the tilt angle of talus also were recovered, the line of force of calcaneus was normal **2h.** Postoperative immediately CT showed the subtalar joint surface was flat **2i,2j.** Postoperative axial and lateral X-rays at 16 months showed the internal fixation had been removed, calcaneal form was normal, no obvious degeneration of subtalar joint surface was found

的。Rammelt 等^[3]采用循骨折线截骨,将陈旧性跟骨骨折变为成新鲜骨折来处理,该方式能纠正各种类型的畸形。但因跟骨多为松质骨,愈合能力强,临床上陈旧性跟骨骨折很难发现原始骨折的痕迹,使得循原始骨折线截骨操作非常困难,且需术中反复透视确定截骨线^[5]。

跟骨骨折后位于最内侧的载距突骨折块因为骨间韧带的维持,一般不发生移位,带有大部分后关节面的外侧骨块常发生塌陷,使内外骨块之间形成台阶;跟骨骨折后虽然骨折愈合较快,但骨折断端之间并未完全骨性愈合,这就为跟骨截骨后撬剥关节面骨折块,将其断端再次分开提供了条件。笔者根据 Essex-Lopresti^[6] II 型中舌型骨折和关节面塌陷形骨块确定 V 形截骨的第 1 条截骨线;第 2 条截骨线根据 Sanders 分型中骨折线位于后关节面的位置确定截骨的深度。手术具体操作为:第 1 条截骨线为塌陷骨块的后关节面软骨与跟骨体形成的界线前方;第 2 条截骨线为从跟骨丘部开始由外向内截至有软骨存在的最内侧部分,并与第 1 条截骨线呈 V 形相交。V 形截骨可以使存在台阶的内外侧骨折块再次断开,将外侧的塌陷关节面骨块完整取出,对关节面重新评估并解剖复位关节面,同时因截骨线位于软骨前方而避免了伤及关节软骨。若存在跟骨力线异常,可沿第 2 条截骨线截至跟骨内侧壁,通过内移或外移跟骨结节来纠正跟骨力线。

V 形截骨术具有无论骨折时间长短均可完整地取出塌陷的骨折块、纠正跟骨力线的异常、无需术中反复透视等优点;但该截骨方式手术技术要求相对较高,若截骨不足可能造成关节面骨块过小而固定困难,同时术中操作时可能造成关节面骨块新的骨折等缺点。

4.2 保留距下关节跟骨 V 形截骨术的手术适应证

保留距下关节跟骨 V 形截骨矫形术治疗陈旧性跟骨骨折具有严格的适应证,其中软骨的质量和是否能通过截骨完整显露塌陷的关节面骨块是判断是否适合该手术的主要手术指征。(1)距下关节软骨质量在治疗陈旧性跟骨骨折选择保留还是融合距下关节中起着关键作用。我们通常认为关节软骨色泽、质地、厚度正常,或仅伴有轻度骨关节炎改变,可考虑保留距下关节。(2)采用 V 形截骨术时,根据 Sanders 分型中骨折线位于后关节面的位置确定截骨的深度。其中 Sanders II、III 型,关节面骨块较大且偏于外侧,V 形截骨较易显露及固定关节面骨块。而 Sanders IV 型因关节面骨折块较多且粉碎严重,V 形截骨很难完整地显露、复位及固定的各个关节面骨块,且后期发生骨性关节炎的概率较大,故此型不宜

采用保关节手术。笔者认为保留距下关节的跟骨 V 形截骨术适应证为距下关节软骨保存较好的 Sanders II、III 型患者。

4.3 治疗体会

(1)术前应与患者进行良好的沟通,根据术中软骨情况决定最终手术方案,且告知患者即使保留了距下关节,后期仍然有可能出现距下关节炎,最终需行距下关节融合内固定术。(2)术中 V 形截骨时切忌暴力操作,如果术中取出塌陷骨折块困难,多因第 2 条截骨线尚未达到塌陷骨块的最内侧,可继续向内侧截骨,切记暴力操作,造成新的关节面骨折块。(3)在复位塌陷的关节骨块前,需对关节面骨块内侧部分机化物及已愈合的断端进行清理,同时清除部分跟骨丘部骨质,为骨块复位提供足够的空间。复位时以距骨关节面为参考模板,术中通过跟骨侧位及 Broden 位评估关节复位情况。(4)在恢复跟骨高度时,需注意撑开的高度,避免皮肤缝合有张力,若最后皮肤缝合有张力,需牺牲部分矫形以保证手术切口的愈合。(5)保留距下关节的跟骨 V 形截骨术不仅能保留患者的距下关节功能,同时可恢复跟骨外形,缓解后足疼痛,提高后足功能等优点。即使患者在行保关节术后发生了距下关节骨性关节炎并伴有疼痛时,因为之前已对跟骨的畸形进行了矫正,恢复了跟骨的高度及纠正了跟骨的力线,距下关节融合术操作也较为简单。

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