

· 临床研究 ·

## 交锁髓内钉固定腓骨下段骨折合并下胫腓损伤

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**摘要:** [目的] 探讨交锁髓内钉联合胫腓螺钉固定腓骨下段骨折合并下胫腓损伤的临床疗效。[方法] 回顾性分析 2019 年 1 月—2022 年 2 月在本院应用交锁髓内钉治疗的腓骨下段骨折合并下胫腓损伤 29 例患者的临床资料。评价临床及影像资料。[结果] 所有患者均顺利完成手术, 手术时间 (51.8±10.3) min, 术中出血量 (68.3±14.3) ml, 切口总长度 (42.5±3.6) mm, 随访时间 (13.7±2.4) 个月。随时间推移, 患者 VAS 评分、AOFAS 评分及踝 ROM 均显著改善 ( $P<0.05$ )。影像方面, 与术前相比, 患者术后 6 个月及末次随访下胫腓骨重叠 (tibiofibular overlap, TFO) [(2.1±0.7) mm, (8.1±1.3) mm, (8.0±1.1) mm,  $P<0.001$ ]、距骨小腿角 (talocrural angle, TCA) [(73.9±4.2)°, (83.1±3.0)°, (82.4±2.9)°,  $P<0.001$ ] 均显著增加, 而下胫腓间隙 (tibiofibular clear space, TFCS) [(8.3±1.3) mm, (4.3±0.5) mm, (4.4±0.5) mm,  $P<0.001$ ] 显著减小。[结论] 交锁髓内钉联合下胫腓螺钉可有效治疗腓骨下段骨折合并下胫腓损伤, 具有切口小, 出血少, 抗旋转, 且下胫腓固定可靠等优势。

**关键词:** 腓骨下段骨折, 髓内钉, 下胫腓联合, 内固定

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**Interlocking intramedullary nail for distal fibular fracture complicated with inferior tibiofibular injury // XU Zheng, LV Fei, XU Wei-wei, DONG Xian-cheng, DU Jian-wei, SHEN Shu-ming. Department of Orthopedics, Yangzhou First People's Hospital, Affiliated Hospital of Yangzhou University, Yangzhou 225000, China**

**Abstract:** [Objective] To investigate the clinical outcomes of interlocking intramedullary nail combined with tibiofibular screw for fixation of distal fibular fracture complicated with inferior syndesmosis injury. [Methods] A retrospective study was conducted on 29 patients who had distal fibular fracture fixed with interlocking intramedullary nail, and tibiofibular syndesmosis fixed by tricortical screw in our hospital from January 2019 to February 2022. The clinical and imaging data were evaluated. [Results] All patients were operated successfully with operation time of (51.8±10.3) min, the intraoperative blood loss of (68.3±14.3) ml, the total incision length of (42.5±3.6) mm, and followed up for (13.7±2.4) months. The VAS score, AOFAS score and ankle ROM were significantly improved over time ( $P<0.05$ ). In terms of imaging, compared with those preoperatively, the inferior tibiofibular overlap (TFO) [(2.1±0.7) mm, (8.1±1.3) mm, (8.0±1.1) mm,  $P<0.001$ ] and talocrural angle (TCA) [(73.9±4.2)°, (83.1±3.0)°, (82.4±2.9)°,  $P<0.001$ ] increased significantly 6 months after surgery and at the latest follow-up, while the tibiofibular clear space (TFCS) decreased significantly [(8.3±1.3) mm, (4.3±0.5) mm, (4.4±0.5) mm,  $P<0.001$ ]. [Conclusion] The interlocking intramedullary nail combined with tibiofibular screw does effectively treat distal fibular fracture complicated with inferior tibiofibular syndesmosis injury, with advantages of small incision, less bleeding, anti-rotation and reliable fixation of the syndesmosis.

**Key words:** distal fibular fracture, intramedullary nail, inferior tibiofibular syndesmosis, internal fixation

腓骨下段骨折多由间接暴力引起, 常合并胫骨远端或胫骨干骨折, 部分合并下胫腓损伤, 单纯腓骨下段骨折较少见<sup>[1]</sup>。在治疗腓骨下段骨折合并下胫腓损伤时, 同时保证腓骨的对位对线和下胫腓联合的完整性, 对术后踝关节的稳定至关重要<sup>[2]</sup>。临床上, 腓骨钢板加拉力螺钉固定已形成共识, 但术后并发症发生率普遍较高, 如切口感染、内固定失效、螺钉断裂或复位丢失等<sup>[3, 4]</sup>。近年来, 随着微创手术理念不断深

入, 腓骨交锁髓内钉应用逐渐广泛, 但对于其应用于腓骨下段骨折合并下胫腓损伤的文献报道较少。本研究将 2019 年 1 月—2022 年 2 月共 29 例在本院行交锁髓内钉治疗腓骨下段骨折合并下胫腓损伤的患者进行回顾性临床疗效分析, 现报告如下。

### 1 临床资料

#### 1.1 一般资料

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回顾性分析本院2019年1月—2022年2月涉及腓骨下段骨折合并下胫腓损伤29例患者的临床资料,其中,男16例,女13例,年龄23~65岁,平均(45.2±12.1)岁。患者影像资料均显示腓骨骨折处距离胫距关节面4.0~8.0 cm,且符合《踝关节外科学》中下胫腓损伤的诊断标准:经踝关节正位X线片测量下胫腓骨重叠(tibiofibular overlap, TFO) ≤6 mm 或下胫腓间隙(tibiofibular clear space, TFCS) ≥6 mm<sup>[5]</sup>。致伤原因:平地走路扭伤9例,上下楼梯摔伤6例,交通事故伤12例,高处坠落伤2例。累及左下肢17例,右下肢12例。骨折按Lauge-Hansen分型,旋前外展型12例,旋前外旋型10例,旋后外旋型7例。其中12例合并内踝骨折,10例合并内踝及后踝骨折,7例合并胫骨干骨折。本研究经医院伦理委员会批准,所有患者均知情同意。

### 1.2 手术方法

麻醉满意后,取仰卧位,患侧大腿近端连接止血带,视骨折具体情况决定先行胫骨或腓骨固定。腓骨髓内钉固定,腓骨尖端远端1 cm处作1.5 cm纵向手术切口。以外踝尖为进针点,置入1.6 mm导针,确保导针在正位片及侧位片上位于腓骨髓腔中心,用6.2 mm电钻沿导针近端开髓,换电钻(3.2 mm或4.2 mm)继续远端扩髓,置入复位杆,拔出导针,选择合适大小(直径3.0 mm或4.0 mm,长度130~230 mm)的腓骨髓内钉。安装瞄准器,沿复位杆插入主钉至合适位置,牵引、旋转复位腓骨骨折,透视满意后置入远端锁定螺钉。点式复位钳加压复位下胫腓联合,通过瞄准器经髓内钉近端孔置入下胫腓螺钉,确保套筒有25°由后向前的角度,下胫腓螺钉均穿透3层骨皮质。透视下内固定在位,复位满意,安装尾帽,冲洗并关闭切口。

### 1.3 评价指标

记录围手术期资料,包括手术时间、术中出血量、切口总长度及术后并发症。采用疼痛视觉模拟评分(visual analogue scale, VAS)、踝关节伸-屈活动度(range of motion, ROM)和美国足踝骨科协会(America Orthopaedic Foot and Ankle Society, AOFAS)评分评价临床疗效。行影像学检查,测量TFO、TFCS及距骨小腿角(talocrural angle, TCA)。

### 1.4 统计学方法

采用IBM SPSS 23.0统计软件对数据进行统计学分析。计量资料以 $\bar{x} \pm s$ 表示,资料符合正态分布,采用单因素方差分析,两两比较采用LSD法。 $P < 0.05$ 为差异具有统计学意义。

## 2 结果

### 2.1 临床结果

所有患者均顺利完成手术。手术时间(51.8±10.3) min,术中出血量(68.3±14.3) ml,切口总长度(42.5±3.6) mm。均未出现切口感染、骨折不愈合或延迟愈合、皮肤坏死等并发症,1例术后3周未遵医嘱过早下地负重,术后9周出现下胫腓螺钉断裂,患者无任何不适,拒绝取出下胫腓螺钉;1例既往房颤病史,术后突发房颤,用药无效后转心内科进行导管消融,痊愈后出院。

患者平均随访时间(13.7±2.4)个月。术后随时间推移,VAS评分、AOFAS评分及踝关节ROM均显著改善,不同时间点间差异具有统计学意义( $P < 0.05$ )。临床骨折愈合时间为术后(14.4±2.1)周。

### 2.2 影像评估

影像测量结果见表1。与术前相比,术后6个月及末次随访,患者TFO和TCA均显著增加( $P < 0.05$ ),而TFCS显著减少( $P < 0.05$ )。典型病例影像见图1。

表1. 29例患者临床和影像资料( $\bar{x} \pm s$ )比较

Table 1. Comparison of clinical and imaging data of the 29 patients ( $\bar{x} \pm s$ )

指标	术前	术后6个月	末次随访	P值
VAS评分(分)	7.8±0.8	3.1±0.6	1.5±0.5	<0.001
AOFAS评分(分)	16.9±6.1	80.0±3.9	87.8±4.9	<0.001
踝ROM(°)	20.7±4.3	54.3±7.5	65.7±5.9	<0.001
TFO(mm)	2.1±0.7	8.1±1.3	8.0±1.1	<0.001
TFCS(mm)	8.3±1.3	4.3±0.5	4.4±0.5	<0.001
TCA(°)	73.9±4.2	83.1±3.0	82.4±2.9	<0.001

## 3 讨论

踝穴稳定性主要依赖于腓骨的正常长度和下胫腓联合的完整性。因此,对于腓骨下段骨折合并下胫腓损伤,同时处理腓骨骨折和下胫腓联合至关重要<sup>[6]</sup>。但腓骨下段肌肉少、血运差,既往多采用切开复位钢板内固定,术后易发生切口愈合不良<sup>[7-8]</sup>。而弹性髓内钉虽对软组织损伤小<sup>[9]</sup>,但存在局限性,尤其抗旋转移位能力不足,且难以固定下胫腓联合。

交锁腓骨髓内钉不仅伤口微创,且远端交锁设计,以及为下胫腓螺钉提供“专孔专用”,共同保证了踝关节术后稳定性。Wordie等<sup>[10]</sup>和Tas等<sup>[11]</sup>均

通过荟萃分析,证明腓骨髓内钉固定骨折可靠且伤口并发症少,适用于软组织条件差的患者。郝红伟

等<sup>[12]</sup>和何红英等<sup>[13]</sup>分别应用腓骨髓内钉治疗踝关节骨折,疗效满意。

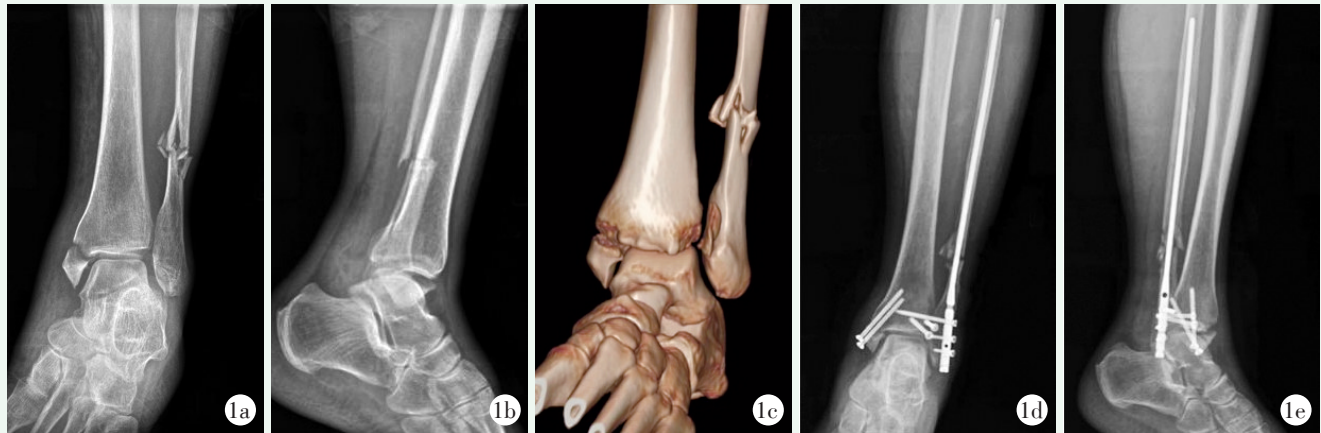


图 1. 患者女性, 60 岁。1a~1c: 术前影像显示左内踝、后踝及左腓骨下段骨折, 伴下胫腓分离, 符合 Lauge-Hansen 分型为旋前-外旋型 IV 度; 1d, 1e: 术后 X 线片示骨折解剖复位, 踝关节间隙对称, 下胫腓对合关系良好。

Figure 1. A 60-year-old female. 1a~1c: Preoperative images showed medial malleolus, posterior malleolus, and lower fibular fractures complicated with inferior tibiofibular separation, consistent with Lauge-Hansen classification as pronation-external rotation IV; 1d, 1e: Postoperative radiographs showed anatomic reduction of fractures, with symmetric ankle space, and good congruency of inferior tibiofibular syndesmosis.

本研究全部手术切口均一期愈合, 无切口愈合不良, 踝关节功能恢复良好。除此之外, 笔者还总结了其他优势: (1) 髓内钉远端自带 10° 外倾角, 符合外踝生理外翻角设计, 无需预弯; (2) 末次随访 TFO、TCA、TFCS 显示较术后无明显差异, 说明髓内钉远端多平面交锁设计能有效维持支撑和抗旋转; (3) 下胫腓螺钉“专用”钉孔, 平行设计, 最多可允许 2 枚螺钉在同一平面拧入, 避免剪力损伤螺钉; (4) 主钉为 3.0 或 4.0 mm 直径设计, 可更好地匹配腓骨髓腔; (5) 髓内钉允许骨折断端实现微动, 刺激骨痂生长, 促进骨折愈合, 本研究无骨折延迟愈合或不愈合病例。

但术者仍需严格把握手术适应证, 对于多数 Weber A 型或严重粉碎性腓骨下段骨折, 以及一些腓骨髓腔过细或过粗的患者, 腓骨髓内钉不适用。术中应避免导针反复开髓, 否则破坏骨内膜血供, 影响骨折愈合。关于术后是否取出下胫腓螺钉, 笔者认为, 虽有断钉风险, 但取钉后出现的下胫腓再分离更难处理, 所以倾向于不取出下胫腓螺钉, 而术后随访只有 1 例螺钉断裂, 可能与过早下地负重有关。

综上所述, 在严格把握适应证和规范操作的前提下, 交锁髓内钉治疗腓骨下段骨折合并下胫腓损伤是一个不错的选择, 创伤小, 出血少, 踝关节功能恢复良好, 下胫腓联合固定稳定。

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