

骨与软组织联合手术治疗伴有痛性副舟骨的柔软性平足症

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【摘要】 目的: 探讨骨与软组织联合手术治疗伴有痛性副舟骨的柔软性平足症的短期临床疗效。方法: 自 2015 年 5 月至 2017 年 8 月, 采用骨与软组织联合手术(腓肠肌松解术、跟骨内移截骨、副舟骨切除胫后肌腱止点重建术)治疗 16 例(16 足)伴有痛性副舟骨的柔软性平足症患者, 其中男 9 例(9 足), 女 7 例(7 足); 年龄 22~48(32.0±3.4)岁, 病程 6~60(28±20)个月。观察患者手术并发症, 比较术前及术后 12 个月距舟覆盖角、距骨第 1 跖骨角、足弓高度、跟骨倾斜角及跟骨外翻角的变化情况, 并于术后 12 个月时采用疼痛视觉模拟评分(visual analogue score, VAS)及美国足踝外科学会(American Orthopedic Foot and Ankle Society, AOFAS)踝与后足评分进行疼痛缓解程度及功能的评价。结果: 16 例患者获得随访, 时间 13~25(18.4±3.5)个月。术后患者伤口均甲级愈合, 未发生伤口感染、骨折不愈合或延迟愈合、内固定断裂或松动等并发症。术后 12 个月患者足部内侧疼痛消失, 运动能力得到恢复。术前负重足侧位 X 线片示足弓高度、跟骨倾斜角、距骨第 1 跖骨角 (21.51±1.20)°、(10.71±1.52)°、(15.61±1.41)°与术后 12 个月 (31.01±1.62)°、(22.12±2.11)°、(5.10±1.20)°比较差异有统计学意义; 负重足正位 X 线片示距舟覆盖角、距骨第 1 跖骨角 (36.12±2.21)°、(13.41±1.51)°与术后 12 个月 (22.12±2.61)°、(4.30±0.91)°比较差异有统计学意义; 术前负重跟骨轴位 X 线片示跟骨外翻角(10.80±1.21)°与术后 12 个月 (3.92±1.81)°比较差异有统计学意义。术后 12 个月 VAS 评分较术前明显改善, 差异有统计学意义[(1.82±0.56)vs (6.21±2.31), $t=2.64, P<0.05$]; 术后 12 个月 AOFAS 评分 87.1±4.7 较术前 51.2±5.6 明显提高($t=3.43, P<0.05$), 其中优 12 例, 良 3 例, 差 1 例。结论: 采用骨与软组织联合手术即腓肠肌松解术、跟骨内移截骨、副舟骨切除胫后肌腱止点重建术治疗伴有痛性副舟骨的柔软性平足症的患者能够明显缓解足部疼痛, 改善足部外观, 提高患者足部功能, 手术疗效确切。

【关键词】 舟骨; 外科手术; 扁平足

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Bone and soft tissue combined with surgery for the treatment soft flatfoot combined with painful navicular bone

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ABSTRACT Objective: To explore short-term clinical effects of bone and soft tissue combined with surgery for the treatment of soft flatfoot accompanied with painful navicular bone. **Methods:** From May 2015 to August 2017, 16 patients (16 feet) with navicular bone soft flatfoot accompanied with painful navicular bone were treated with bone and soft tissues operation (gastrocnemius release, medial displacement calcaneal osteotomy, and excision of accessory navicular with reconstruction of posterior tibial tendon). Among them, there were 9 males (9 feet) and 7 females (7 feet), aged from 22 to 48 years old with an average of (32.0±3.4) years old. The duration of diseases ranged from 6 months to 5 years with an average of (2.4±1.7) years. The postoperative complications were observed, talocalcaneal angle, the first metatarsal horn of the talus, arch height, angle of inclination and calcaneal valgus before and after operation at 12 months were compared. VAS score and AOFAS score after operation at 12 months were applied to evaluate pain relief and function. **Results:** All patients were followed up for an average of (18.4±3.5) months (13~25 months). The incisions of patients were healed at grade A without wound infection, nonunion or delayed union, internal fixation fracture or loosening and other complications. Medial pain of foot was disappeared and motor ability was restored at 12 months after operation. Arch height, angle of inclination and the first metatarsal horn of the talus of lateral X-ray before operation and after operation at 12 months on weight-bearing foot were (21.51±1.20)° vs (31.01±1.62)°, (10.71±1.52)° vs (22.12±2.11)°, (15.61±1.41)° vs (5.10±1.20)°; talocalcaneal angle, the first metatarsal horn of the talus of AP X-ray before operation and after operation at 12 months on weight-bearing foot were (36.12±2.21)° vs (22.12±2.61)°,

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(13.41 ± 1.51) $^{\circ}$ vs (4.30 ± 0.91) $^{\circ}$; calcaneal valgus of axial X-ray before operation and after operation at 12 months on weight-bearing foot were (10.80 ± 1.21) $^{\circ}$ vs (3.92 ± 1.81) $^{\circ}$; there were statistical difference in imaging indicators between preoperation and 12 months after operation. VAS score was significantly decreased from (6.21 ± 2.31) before operation to (1.82 ± 0.56) at 12 months after operation ($t=2.64, P<0.05$). AOFAS score was obviously increased from (51.2 ± 5.6) before operation to (87.1 ± 4.7) at 12 months after operation ($t=3.43, P<0.05$). **Conclusion:** Bone and soft tissue operation (namely, gastrocnemius release, medial displacement calcaneal osteotomy, and excision of accessory navicular with reconstruction of posterior tibial tendon) could obviously relieve foot pain, improve foot appearance and function in patients with navicular bone soft flatfoot complicated with painful navicular bone, and has certain clinical efficacy.

KEYWORDS Scaphoid bone; Surgical procedures, operative; Flatfoot

平足症以足纵弓的塌陷或消失为特征,其发病原因最常见的是胫后肌腱功能不全,其次为中足骨性关节炎、创伤等。副舟骨为足部最常见的副骨,多双侧对称出现,发生率为 10%~14%,但仅仅不足 1% 的人出现有症状的副舟骨^[1]。副舟骨通常是平足的典型表现之一,但是平足的程度和副舟骨炎的进展及严重程度无关。手术治疗伴有痛性副舟骨的柔软性平足患者各有优缺点,但尚无统一标准。自 2015 年 5 月至 2017 年 8 月采用骨与软组织联合手术治疗 16 例(16 足)伴有痛性副舟骨的柔软性平足症患者,疗效满意,现报告如下。

1 临床资料

本组 16 例(16 足),男 9 例(9 足),女 7 例(7 足);左足 10 例,右足 6 例;年龄 22~48(32.0 ± 3.4)岁;病程 6~60(28 ± 20)个月。根据副舟骨分型^[2]: I 型副舟骨 3 例, II 型副舟骨 11 例, III 型副舟骨 2 例。12 例患者有明确外伤病史。术前所有患者有足内侧疼痛及穿鞋困难,不能长距离行走、参加体育运动,严重影响日常生活。所有患者经过保守治疗 6 个月以上,症状未见明显好转。术前常规拍摄负重位足正位、侧位 X 线片及后跟负重轴位 X 线片,显示存在副舟骨、后跟外翻及足弓塌陷等。根据患者情况选择是否需拍摄核磁共振 MRI 了解胫后肌腱有无变性断裂。术前通过 Silfverskiold 试验鉴别腓肠肌挛缩和跟腱挛缩,当踝关节最大背伸角度在膝关节伸直位时 < 5 $^{\circ}$,在膝关节屈曲 90 $^{\circ}$ 时 > 10 $^{\circ}$,证实腓肠肌挛缩。

2 治疗方法

患者采用全身麻醉,仰卧位,大腿常规使用止血带。取小腿内侧纵行切口约 3 cm,显露腓肠肌腱膜交界处,注意保护大隐静脉及腓肠神经,打开腓肠肌腱鞘膜。伸直膝关节,背伸踝关节,使腓肠肌腱保持一定的张力,以尖刀横行松解腓肠肌腱,用力背伸踝关节延长腓肠肌。沿跟骨外侧斜行切口约 3 cm,该切口位于腓骨肌腱与腓肠神经后下方,基本与腓骨肌腱平行。以骨刀截骨,截骨平面与足底呈 45 $^{\circ}$,且须与跟骨垂直,从距骨后缘后方 1~1.5 cm 处向跗侧沿伸至跟骨下结节远侧 1~1.5 cm 处,截骨时应完全穿

透跟骨内侧壁。内移跟骨约 1.0~1.5 cm 或跟骨宽度的 1/3~1/2,纠正跟骨外翻,拍摄跟骨侧位及轴位 X 线片以评估跟骨内移情况,推移满意后以 1~2 枚 6.5 mm 全螺纹空心钉固定跟骨。沿足内侧弧形切口 3~4 cm,显露副舟骨及胫后肌腱,切除副舟骨,修整距骨内侧凸起部分,使其与楔骨内侧缘齐平,清理胫后肌腱炎性组织,将足舟骨内侧处打磨至新鲜骨面。再以 4.5 mm 可吸收锚钉将胫后肌腱重建于足舟骨跖内侧,并使胫后肌腱保持适当的张力,以维持足弓。缝合手术切口,加压包扎,以石膏固定踝关节于跖屈内翻 20 $^{\circ}$ 位。

术后常规使用抗生素及消肿药物,抬高患肢以促进下肢消肿,鼓励患者行股四头肌力量练习。4 周后更换石膏,再次石膏固定踝关节于中立位 2 周。6 周后开始踝关节功能锻炼,并佩戴行走靴部分负重至影像学检查证实截骨处骨性愈合。

3 结果

3.1 疗效评价标准

术后 12 个月采用疼痛视觉模拟评分(VAS)^[3]评估患者疼痛缓解程度,并采用美国足踝外科协会(American Orthopedic Foot and Ankle Society, AOFAS)踝与后足评分^[4]从疼痛(40 分),功能(45 分),对线(15 分)3 方面对足踝功能进行评价,满分 100 分;总分 90~100 分为优,75~89 分为良,50~74 分为可,50 分以下为差。

3.2 治疗结果

16 例患者获得随访,时间 13~25 (18.4 ± 3.5)个月。骨折愈合时间 10.4~14.5(11.5 ± 2.4)周。所有患者手术切口均甲级愈合,未发生感染病例、未发现内固定松动或断裂等并发症。VAS 评分由术前的 6.21 ± 2.31 降低至术后 12 个月的 1.82 ± 0.56 ($t=2.64, P<0.05$)。术前负重位侧位 X 线片示足弓高度、跟骨倾斜角、距骨第 1 跗骨角分别为 (21.51 ± 1.20) $^{\circ}$ 、(10.71 ± 1.52) $^{\circ}$ 、(15.61 ± 1.41) $^{\circ}$,与术后 12 个月 (31.01 ± 1.62) $^{\circ}$ 、(22.12 ± 2.11) $^{\circ}$ 、(5.10 ± 1.20) $^{\circ}$ 比较差异有统计学意义;负重位正位 X 线片示距舟覆盖角、距骨第 1 跗骨角为 (36.12 ± 2.21) $^{\circ}$ 、($13.41 \pm$

表 1 伴有痛性副舟骨的柔软性平足症患者 16 例术前与术后 12 个月影像学结果比较($\bar{x}\pm s, ^\circ$)

Tab.1 Comparison of preoperative and postoperative radiographic parameters at 12 months of 16 patients with soft flatfoot combined with painful navicular bone($\bar{x}\pm s, ^\circ$)

X 线片体位	观察项目	术前	术后 12 个月	t 值	P 值
负重足侧位片	足弓高度	21.51±1.20	31.01±1.62	2.13	<0.05
	跟骨倾斜角	10.71±1.52	22.12±2.11	2.24	<0.05
	距骨第 1 跖骨角	15.61±1.41	5.10±1.20	2.43	<0.05
负重足正位片	距舟覆盖角	36.12±2.21	22.12±2.61	2.35	<0.05
	距骨第 1 跖骨角	13.41±1.51	4.30±0.91	2.37	<0.05
负重跟骨轴位片	跟骨外翻角	10.80±1.21	3.92±1.81	2.93	<0.05

1.51)°,与术后 12 个月 (22.12±2.61)°、(4.30±0.91)°比较差异有统计学意义;术前负重跟骨轴位 X 线片示跟骨外翻角(10.80±1.21)°,与术后 12 个月 (3.92±1.81)°比较差异有统计学意义。结果见表 1。手术前后 AOFAS 评分比较差异有统计学意义 ($P<0.05$,表 2);其中优 12 例,良 3 例,差 1 例。典型病例见图 1。

表 2 伴有痛性副舟骨的柔软性平足症患者 16 例术前与术后 12 个月 AOFAS 评分比较($\bar{x}\pm s$,分)

Tab.2 Comparison of preoperative and postoperative AOFAS score at 12 months of 16 patients with soft flatfoot combined with painful navicular bone($\bar{x}\pm s$,score)

时间	疼痛	功能	对线	总分
术前	16.0±4.3	28.6±5.4	5.38±3.2	51.2±5.6
术后 12 个月	37.4±5.7	35.4±5.9	12.7±3.6	87.1±4.7
t 值	3.719	3.087	3.153	3.43
P 值	<0.05	<0.05	<0.05	<0.05

4 讨论

4.1 副舟骨合并平足的发病机制

副舟骨是由幼年时未能与足舟骨结节相结合的副骨化中心发展而来,两者由结缔组织、类软骨或纤维软骨连接。当存在副舟骨时,胫后肌腱大部分附着于副舟骨上,而不是舟骨下方,这使得胫后肌腱对足弓的稳定作用下降,同时使副舟骨及内侧纵弓的支持组织易发生持续的疲劳及慢性劳损而引起足内侧疼痛^[5]。副舟骨分为 3 型^[2]: I 型,小的籽骨,为胫后肌肌腱内的圆形籽骨,约 30%; II 型,籽骨稍大,多为三角形,副舟骨与舟骨体之间通过纤维软骨连接; III 型,足副舟骨与足舟骨之间已骨性连接, II 型及 III 型约 70%。当存在副舟骨时,胫后肌腱走行和止点发生改变,削弱了胫后肌腱提起足弓及足内翻的作用,破坏了足弓的生物力学,从而引发平足。

4.2 伴痛性副舟骨的柔软性平足的治疗方法

对于伴有痛性副舟骨的柔软性平足患者仍然常

规首先采用保守治疗,主要包括力量训练、非甾体抗炎药、局部注射皮质类固醇、鞋垫、夜用夹板、改良鞋等。关于保守治疗时间,Myerson 等^[6]认为超过 6 周无效,应尽快行腱鞘滑膜切除术,以预防潜在的肌腱断裂。但大多数学者仍提倡可先行 3~6 个月的保守治疗,若保守治疗后症状未见缓解者再考虑行手术治疗^[7]。手术治疗伴有痛性副舟骨的柔软性平足主要分为两部分:(1)治疗有症状的副舟骨。(2)矫正平足畸形及相应症状^[8]。单纯副舟骨切除术及副舟骨与舟骨融合术虽然可取得良好的疗效,但不能改善患者足弓及纠正后跟外翻,且后期有加重足弓塌陷的风险^[9]。副舟骨切除联合胫后肌腱止点重建不仅能缓解患者疼痛,恢复胫后肌腱功能,而且能够部分恢复足弓,但对足部生物力学的改变极小。采用跟骨内移截骨、副舟骨切除胫后肌腱止点重建治疗与副舟骨相关的平足症患者可取得良好疗效^[8]。三关节融合术仅适用于多关节骨性关节炎患者或僵硬性平足畸形。

4.3 骨与软组织联合手术的优点及手术操作注意事项

既往的手术方式忽视了腓肠肌挛缩在造成平足症的作用,腓肠肌挛缩后导致跟腱过度牵拉跟骨结节,进而引起距下关节的外翻及中足关节的解锁,能够诱发或加重足弓塌陷。而胫后肌腱功能不全、腓肠肌挛缩、弹簧韧带功能障碍是引起平足症最常见的组合原因^[5]。故笔者在手术治疗柔软性平足时加做腓肠肌松解术。笔者认为腓肠肌松解、副舟骨切除胫后肌腱止点重建、跟骨内移截骨手术具有以下优点:(1)松解腓肠肌缓解前、中足压力,消除跟骨外翻的致畸作用。(2)不仅切除了痛性副舟骨,而且将胫后肌腱重建于足舟骨跖内侧,符合胫后肌腱的生物力学线,有利于胫后肌腱发挥作用。(3)跟骨截骨内移,纠正跟骨外翻,有利于保护重建后的胫后肌腱,消除跟腱的致畸作用,恢复后足力线及足踝部生物力学特点。手术中应注意事项:(1)术中注意保护腓肠神经,

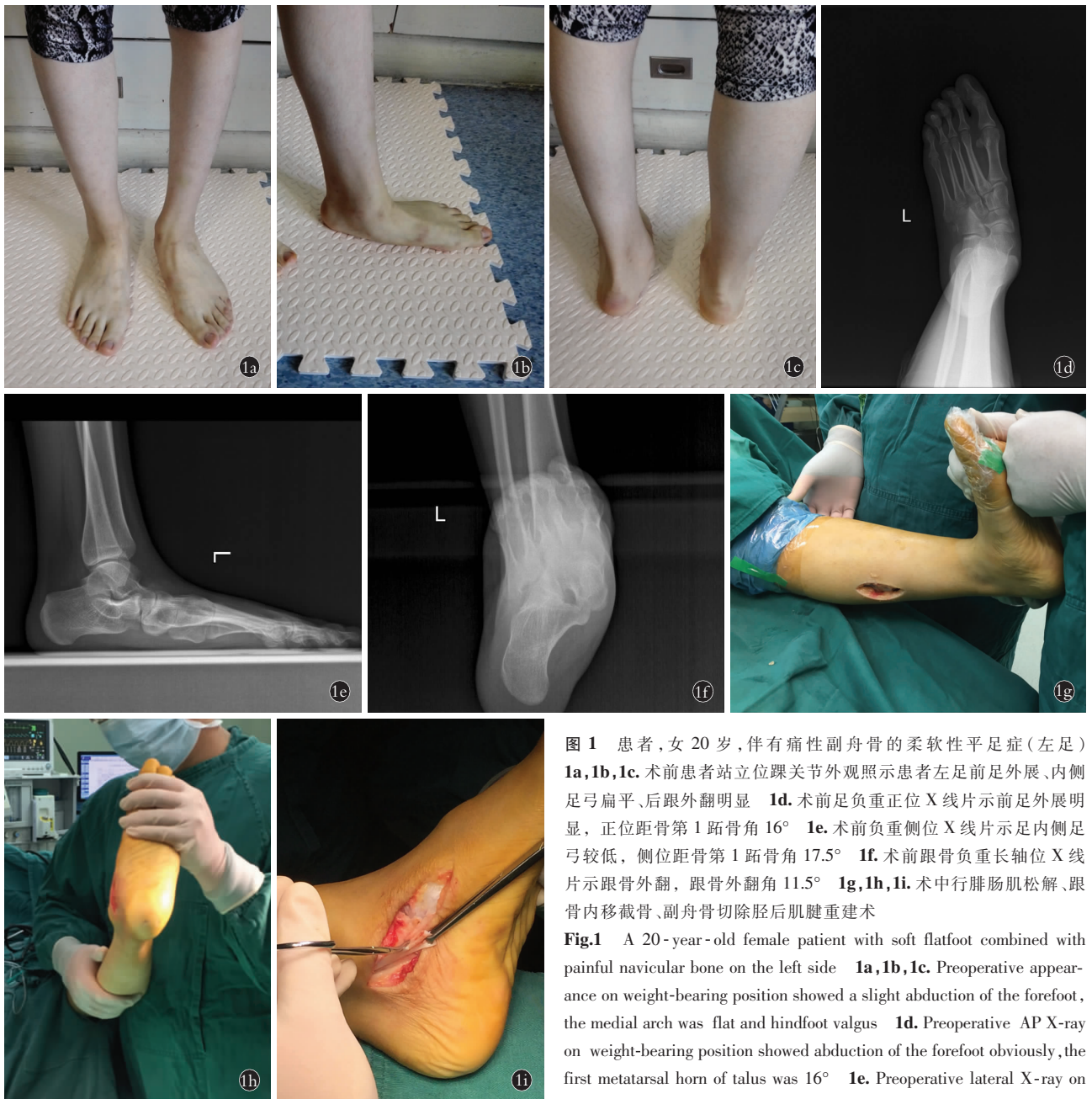


图 1 患者,女 20 岁,伴有痛性副舟骨的柔软性平足症(左足) 1a,1b,1c. 术前患者站立位踝关节外观照示患者左足前足外展、内侧足弓扁平、后跟外翻明显 1d. 术前负重正位 X 线片示前足外展明显, 正位距骨第 1 跖骨角 16° 1e. 术前负重侧位 X 线片示足内侧足弓较低, 侧位距骨第 1 跖骨角 17.5° 1f. 术前跟骨负重长轴位 X 线片示跟骨外翻, 跟骨外翻角 11.5° 1g, 1h, 1i. 术中行腓肠肌松解、跟骨内移截骨、副舟骨切除胫后肌腱重建术

Fig.1 A 20-year-old female patient with soft flatfoot combined with painful navicular bone on the left side 1a, 1b, 1c. Preoperative appearance on weight-bearing position showed a slight abduction of the forefoot, the medial arch was flat and hindfoot valgus 1d. Preoperative AP X-ray on weight-bearing position showed abduction of the forefoot obviously, the first metatarsal horn of talus was 16° 1e. Preoperative lateral X-ray on weight-bearing position showed the arch of the foot was flat, the first metatarsal horn of lateral talus was 17.5° 1f. Preoperative long axis X-ray on weight-bearing position showed eversion of heel bone, and the angle was 11.5° 1g, 1h, 1i. Gastrectomy, medial displacement calcaneal osteotomy, reconstruction of tibialis tendon after excision of accessory navicular bone were performed in operation

1g, 1h, 1i. 术中行腓肠肌松解、跟骨内移截骨、副舟骨切除胫后肌腱重建术

术中需打开腓肠肌腱鞘膜, 在鞘膜内松解腓肠肌可避免损伤腓肠神经, 尖刀松解后用力背伸踝关节延长腓肠肌。(2)跟骨内移截骨时应完全穿透跟骨内侧壁, 亦可用骨剥通过截骨处轻柔地松解内侧软组织, 这样更利于内移跟骨, 理论上在内移跟骨的时候同时将跟骨下拉可增加足弓高度, 但实际操作困难。(3)切除副舟骨后需仔细修整距骨内侧凸起部分, 以免残留骨性突起刺激胫后肌腱引起疼痛。胫后肌腱重新固定于足舟骨跖内侧, 这样有利于发挥胫后肌

腱维持足弓的作用。(4)术后笔者将踝关节石膏固定于跖屈内翻 20°位, 减少胫后肌腱的张力, 为胫后肌腱愈合创造条件。

笔者采用腓肠肌松解、副舟骨切除胫后肌腱止点重建、跟骨内移截骨术治疗伴痛性副舟骨的柔软性平足 16 例(16 足), 有效地缓解了患者足部的疼痛, 提高了足部的功能, 取得了满意的临床疗效。此手术方式主要适用于伴有痛性副舟骨的柔软性平足患者, 出现后跟外翻畸形, 但畸形无固定, 相当于成

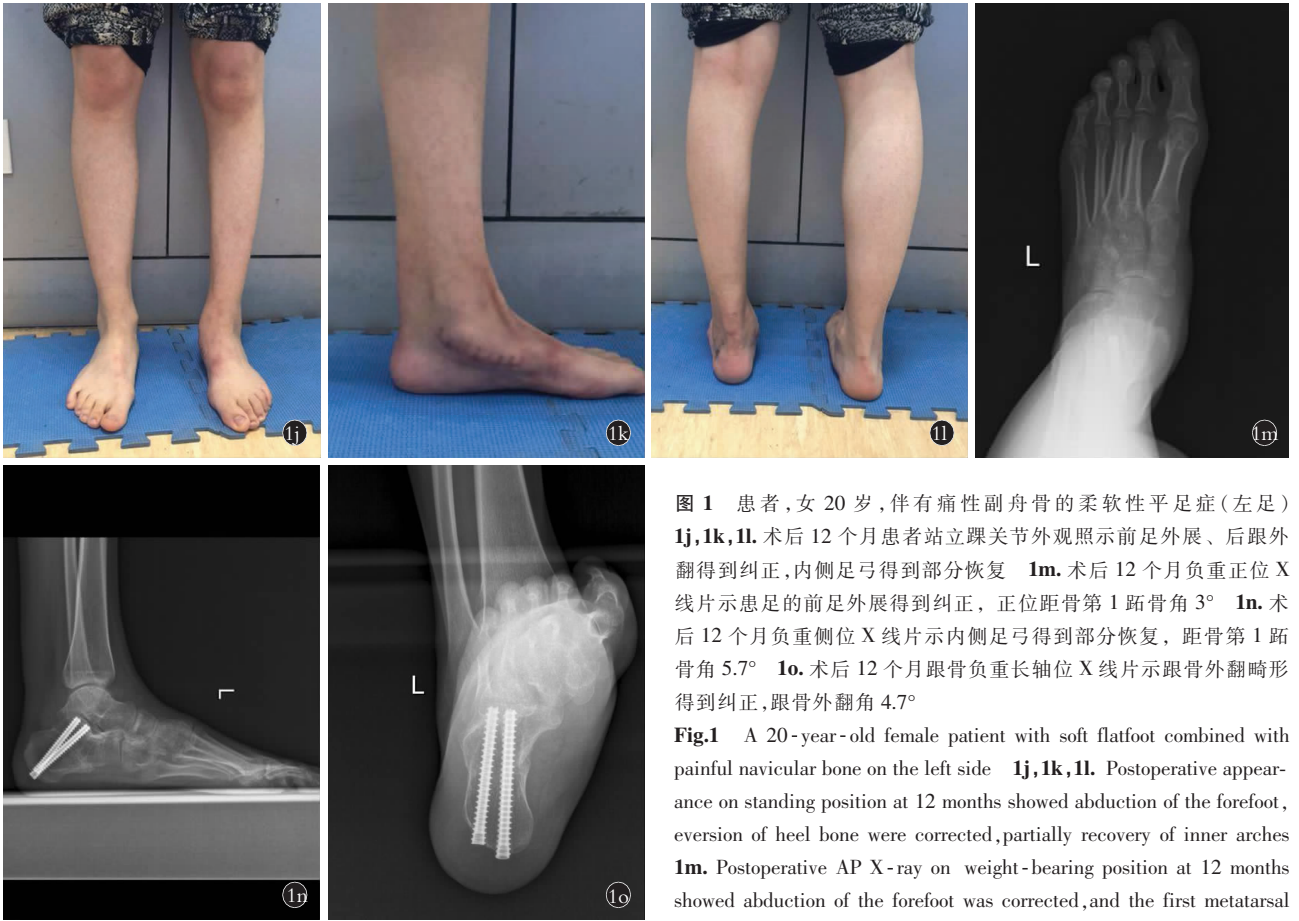


图 1 患者,女 20 岁,伴有痛性副舟骨的柔软性平足症(左足) 1j,1k,1l. 术后 12 个月患者站立踝关节外观照示前足外展、后跟外翻得到纠正,内侧足弓得到部分恢复 1m. 术后 12 个月负重正位 X 线片示患足的前足外展得到纠正,正位距骨第 1 跖骨角 3° 1n. 术后 12 个月负重侧位 X 线片示内侧足弓得到部分恢复,距骨第 1 跖骨角 5.7° 1o. 术后 12 个月跟骨负重长轴位 X 线片示跟骨外翻畸形得到纠正,跟骨外翻角 4.7°

Fig.1 A 20-year-old female patient with soft flatfoot combined with painful navicular bone on the left side 1j,1k,1l. Postoperative appearance on standing position at 12 months showed abduction of the forefoot, eversion of heel bone were corrected, partially recovery of inner arches 1m. Postoperative AP X-ray on weight-bearing position at 12 months showed abduction of the forefoot was corrected, and the first metatarsal horn of talus on anteroposterior position was 3° 1n. Postoperative lateral

X-ray on weight-bearing position at 12 months showed partially recovery of inner arches, the first metatarsal horn of talus was 5.7° 1o. Postoperative long axis X-ray on weight-bearing position at 12 months showed eversion and deformity of heel bone were corrected, and the angle of calcaneal valgus was 4.7°

人获得性平足症 II A、II B 期(Johnson-strom 分期)。若患者的后足已固定性畸形或已有骨性关节炎的表现,本手术方式只可作为补充手术方式。本研究病例随访时间较短,病例数量相对较少,其中长期疗效仍需进一步观察,且需要生物力学试验进一步证明其有效性。

经过对病例严格筛选,对伴有痛性副舟骨的柔软性平足症患者,采用骨与软组织联合手术,即腓肠肌松解术、副舟骨切除胫后肌腱止点重建、跟骨内移截骨术治疗能够明显矫正足弓塌陷,改善足部外观,缓解足部疼痛,改善足部功能,短期疗效满意。

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