术后开始负重时间对第五跖骨基底部骨折
手术效果影响的临床研究

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摘　要　**目的**:观察术后开始负重时间对第五跖骨基底部骨折手术效果的影响。**方法**:选择 68 例采用切开复位内固定手术治疗的第五跖骨基底部骨折患者,患者术后均以短腿石膏固定。34 例术后 3 d 开始完全负重行走(早负重组),其余 34 例术后 4 周开始完全负重行走(晚负重组)。比较 2 组患者的骨折愈合时间、骨折部位骨吸收发生率、足部疼痛视觉模拟量表(visual analogue scale,VAS)评分、美国足与踝关节协会(American Orthopedic Foot and Ankle Society,AOFAS)踝与后足功能评分及并发症发生情况。**结果**:①骨折愈合情况。所有患者均获得 12 个月随访。2 组患者的骨折均愈合,骨折愈合时间的差异无统计学意义[(6.3 ± 1.1)周,(6.8 ±1.6)周,$t = 1.502,P = 0.138$]。早负重组 2 例患者发生骨折部位骨吸收、晚负重组 9 例患者发生骨折部位骨吸收,晚负重组骨折部位骨吸收发生率高于早负重组($\chi^2 = 5.314,P = 0.021$)。②足部疼痛 VAS 评分。时间因素和分组因素不存在交互效应($F = 1.813,P = 0.174$)。2 组患者足部疼痛 VAS 评分总体比较,差异无统计学意义,即不存在分组效应($F = 0.978,P = 0.432$)。手术后不同时间点间足部疼痛 VAS 评分的差异有统计学意义,即存在时间效应($F = 11.381,P = 0.000$);2 组患者足部疼痛 VAS 评分随时间延长均呈降低趋势[早负重组:(3.1 ±1.6)分,(1.7 ±2.3)分,(0.1 ±0.4)分,$F = 0.951,P = 0.000$;晚负重组:(3.5 ±2.6)分,(2.3 ±2.8)分,(0.2 ±0.6)分,$F = 5.739,P = 0.000$]。③AOFAS 踝与后足功能评分。时间因素和分组因素不存在交互效应($F = 1.947,P = 0.159$)。早负重组的 AOFAS 踝与后足功能评分总体高于晚负重组($F = 2.018,P = 0.039$)。手术后不同时间点间 AOFAS 踝与后足功能评分的差异有统计学意义,即存在时间效应($F = 13.916,P = 0.000$);2 组患者 AOFAS 踝与后足功能评分随时间延长均呈升高趋势[早负重组:(75.3 ±6.8)分,(89.7 ±9.3)分,(99.1 ±7.7)分,$F = 0.837,P = 0.000$;晚负重组:(72.5 ±9.9)分,(82.3 ±10.1)分,(96.8 ±7.6)分,$F = 6.147,P = 0.000$]。④并发症发生情况。2 组患者均未发生切口感染、骨折再移位等并发症。**结论**:第五跖骨基底部骨折采用切开复位内固定手术治疗后,无论早负重还是晚负重均可获得满意的临床疗效,而且安全性较高,但早负重更有利于足踝功能恢复、降低骨折部位骨吸收发生率。

关键词　负重;第五跖骨;骨折固定术,内;临床试验

Influence of postoperative full weight-bearing walking start time on clinical therapeutic effects of surgery for treatment of the fifth metatarsal base fractures:a clinical study

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ABSTRACT　**Objective**:To observe the influence of postoperative full weight-bearing walking start time on clinical therapeutic effects of surgery for treatment of the fifth metatarsal base fractures. **Methods**:The medical records of 68 patients with the fifth metatarsal base fractures were analyzed retrospectively. The patients received surgery of open reduction and internal fixation and their affected limbs were fixed with short – leg casts after the surgery. The full weight-bearing walking were performed at 3 days after the surgery in 34 patients(early weight-bearing(EWB)group)and at 4 weeks after the surgery in the others(late weight-bearing(LWB)group)respectively. The fracture healing time,incidence of bone resortion at fractured site,foot pain visual analogue scale(VAS)scores,American Orthopedic Foot and Ankle Society(AOFAS)ankle – hindfoot function scores and complication incidence were compared between the 2 groups. **Results**:All patients in the 2 groups were followed up for 12 months. All fractures healed in the 2 groups,and there was no statistical difference in fracture healing time between the 2 groups($6.3 ± 1.1$ vs $6.8 ± 1.6$ weeks,$t = 1.502,P = 0.138$). The bone resortion was found at fractured site in 2 patients in EWB group and 9 patients in LWB group. The incidence of bone resortion at fractured site was higher in LWB group compared to EWB group($\chi^2 = 5.314,P = 0.021$). There was no interaction between time factor and group factor in foot pain VAS scores($F = 1.813,P = 0.174$). There was no statistical difference in foot pain VAS scores between the 2 groups in general,in other words,there was no group effect($F = 0.978,P = 0.432$). There was statistical difference in foot pain VAS scores between different timepoints after the surgery,in other words,there was time effect($F = 11.381,P = 0.000$). The foot pain VAS scores presented a time – dependent decreasing trend in the 2

groups(EWB group:3. 1 ± 1. 6,1. 7 ± 2. 3,0. 1 ± 0. 4 points, $F = 0.951$, $P = 0.000$; LWB group:3. 5 ± 2. 6,2. 3 ± 2. 8,0. 2 ± 0. 6 points, $F = 5.739$, $P = 0.000$). There was no interaction between time factor and group factor in AOFAS ankle – hindfoot function scores($F = 1.947$, $P = 0.159$). The AOFAS ankle – hindfoot function scores were higher in EWB group compared to LWB group in general, in other words,there was group effect($F = 2.018$, $P = 0.039$). There was statistical difference in AOFAS ankle – hindfoot function scores between different timepoints after the surgery,in other words,there was time effect($F = 13.916$, $P = 0.000$). The AOFAS ankle – hindfoot function scores presented a time – dependent increasing trend in the 2 groups(EWB group:75. 3 ± 6. 8,89. 7 ± 9. 3,99. 1 ± 7. 7 points, $F = 0.837$, $P = 0.000$; LWB group:72. 5 ± 9. 9,82. 3 ± 10. 1,96. 8 ± 7. 6 points, $F = 6.147$, $P = 0.000$). No complications such as incision infection and fracture re-displacement were found in the 2 groups. **Conclusion**:For patients who received surgery of open reduction and internal fixation for treatment of the fifth metatarsal base fractures,both EWB and LWB can achieve good clinical curative effects with high safety. However,the former is more conducive to foot and ankle function recovery and reducing incidence of bone resorption at fractured site compared to the latter.

Keywords　weight-bearing;fifth metatarsal bone;fracture fixation,internal;clinical trial

第五跖骨基底部骨折在跖骨骨折中较为常见[1-2]。目前多数学者倾向于手术治疗第五跖骨基底部骨折,但对术后是否允许患者早期完全负重,仍存在争议[3-5]。部分学者建议术后石膏制动 4 周后负重行走[6-9],另一些学者则认为术后 3 d 即可带石膏完全负重行走[10-13]。为明确术后开始负重时间对第五跖骨基底部骨折手术效果的影响,我们对以往收治的术后 3 d 开始负重和术后 4 周开始负重的此类骨折患者的病例资料进行了比较,现总结报告如下。

1　临床资料

1.1　一般资料　以 2010 年 3 月至 2019 年 3 月在嘉兴市第一医院住院治疗的第五跖骨基底部骨折患者为研究对象。试验方案经医院医学伦理委员会审核通过。

1.2　纳入标准　①经临床和影像学检查确诊为第五跖骨基底部骨折;②年龄≥18 岁;③闭合性骨折;④单侧骨折;⑤骨折区域为Ⅰ区或Ⅱ区[14];⑥病例资料完整。

1.3　排除标准　①合并同侧其他部位骨折者;②病理性或应力性骨折者;③合并踝关节骨关节炎者;④合并精神障碍者。

2　方　法

2.1　分组方法　按照术后开始负重时间将患者分为早负重组和晚负重组。

2.2　治疗方法　2 组患者均采用切开复位内固定术治疗。采用全身麻醉,患者取仰卧位,患肢上充气止血带。以骨折线为中心,做长约 4 cm 的切口,逐层显露骨折,清除骨折块间的软组织。复位后采用 1 枚空心加压螺钉或克氏针张力带内固定。术后以短腿石膏外固定,抬高患肢,常规应用抗生素预防感染。术后 3 d 拍摄 X 线片复查骨折复位情况。早负重组术后 3 d 开始完全负重行走;晚负重组术后先鼓励患者行髋关节、膝关节、足趾关节活动,术后 4 周开始完全负重行走。2 组患者均于术后 4 周拆除石膏外固定,开始踝关节功能锻炼。

2.3　疗效及安全性比较方法　比较 2 组患者的骨折愈合时间、骨折部位骨吸收发生率、足部疼痛程度、足踝功能及并发症发生情况。足部疼痛程度采用视觉模拟量表(visual analogue scale,VAS) 评定,足踝功能均采用美国足与踝关节协会(American Orthopedic Foot and Ankle Society,AOFAS) 踝与后足功能评分标准[15]评定。

2.4　数据统计方法　采用 SPSS19. 0 软件进行数据统计分析。2 组患者性别、骨折区域、骨折侧别、骨折部位骨吸收发生率的组间比较均采用 χ^2 检验,年龄、受伤至手术时间、体质量指数、骨折愈合时间的组间比较均采用 t 检验,足部疼痛 VAS 评分、AOFAS 踝与后足功能评分的总体比较均采用重复测量资料的方差分析。检验水准 $\alpha = 0.05$ 。

3　结　果

3.1　分组结果　共纳入 68 例患者,早负重组和晚负重组各 34 例。2 组患者的基线资料比较,差异无统计学意义,有可比性(表 1)。

3.2　疗效及安全性比较结果

3.2.1　骨折愈合情况　所有患者均获得 12 个月随访。2 组患者的骨折均愈合,骨折愈合时间的差异无统计学意义[(6. 3 ± 1. 1) 周,(6. 8 ± 1. 6) 周, $t = 1.502$, $P = 0.138$]。早负重组 2 例患者发生骨折部位骨吸收、晚负重组 9 例患者发生骨折部位骨吸收,晚负重组骨折部位骨吸收发生率高于早负重组($\chi^2 = 5.314$, $P = 0.021$)。典型病例 X 线片见图 1、图 2。

3.2.2　足部疼痛 VAS 评分　时间因素和分组因素

不存在交互效应。2 组患者足部疼痛 VAS 评分总体比较，差异无统计学意义，即不存在分组效应。手术后不同时间点间足部疼痛 VAS 评分的差异有统计学意义，即存在时间效应；2 组患者足部疼痛 VAS 评分随时间延长均呈降低趋势。见表 2。

组因素不存在交互效应。早负重组的 AOFAS 踝与后足功能评分总体高于晚负重组。手术后不同时间点间 AOFAS 踝与后足功能评分的差异有统计学意义，即存在时间效应；2 组患者 AOFAS 踝与后足功能评分随时间延长均呈升高趋势。见表 3。

3.2.3　AOFAS 踝与后足功能评分　时间因素和分

表 1　2 组第五跖骨基底部骨折患者基线资料

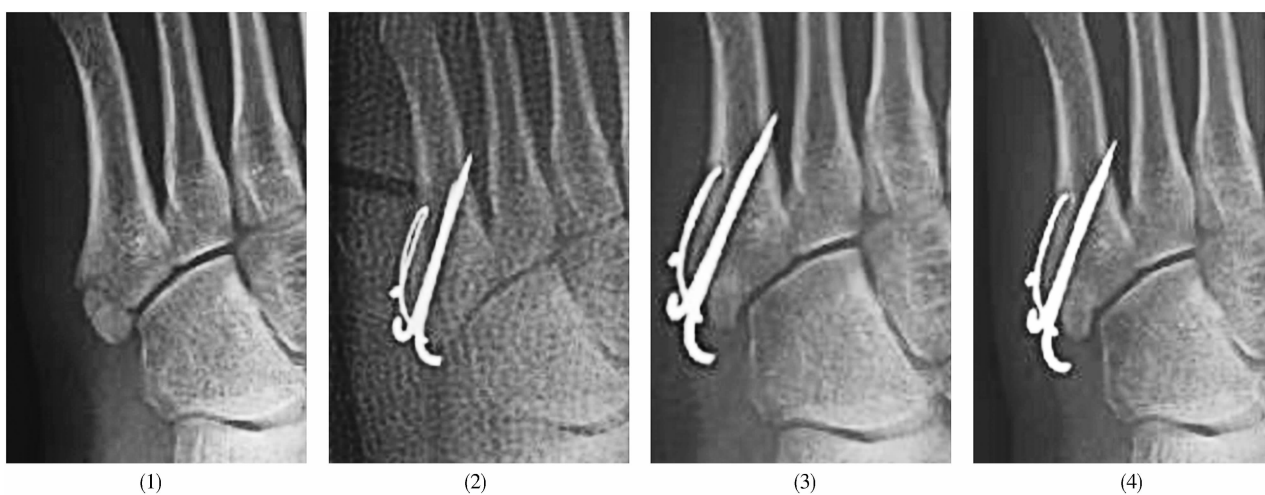| 组别 | 样本量/例 | 性别/例 | | 年龄/($\bar{x} \pm s$,岁) | 骨折区域[1]/例 | | 骨折侧别/例 | | 受伤至手术时间/($\bar{x} \pm s$,d) | 体质量指数/($\bar{x} \pm s$,kg·m^{-2}) |
		男	女		Ⅰ区	Ⅱ区	左侧	右侧		
早负重组	34	20	14	37.3 ± 11.3	13	21	21	13	3.5 ± 1.2	22.3 ± 8.4
晚负重组	34	19	15	38.1 ± 12.6	17	17	19	15	3.4 ± 1.6	22.4 ± 6.9
检验统计量		$\chi^2 = 0.060$		$t = 0.276$	$\chi^2 = 0.954$		$\chi^2 = 0.243$		$t = 0.421$	$t = 0.054$
P 值		0.806		0.784	0.329		0.622		0.516	0.957

1）骨折区域中Ⅰ区指第五跖骨基底粗隆部，Ⅱ区指第五跖骨基底干骺端。

图 1　典型病例 1 X 线片

注：患者，男，33 岁，右侧第五跖骨基底部骨折，采用切开复位克氏针张力带内固定治疗，并以短腿石膏外固定，术后 3 d 开始完全负重；(1)术前正位 X 线片示第五跖骨基底部骨折（Ⅰ区）；(2)术后 3 d 正位 X 线片示骨折复位满意；(3)术后 1 个月正位 X 线片示骨折无移位；(4)术后 12 个月正位 X 线片示骨折骨性愈合，关节间隙无狭窄。
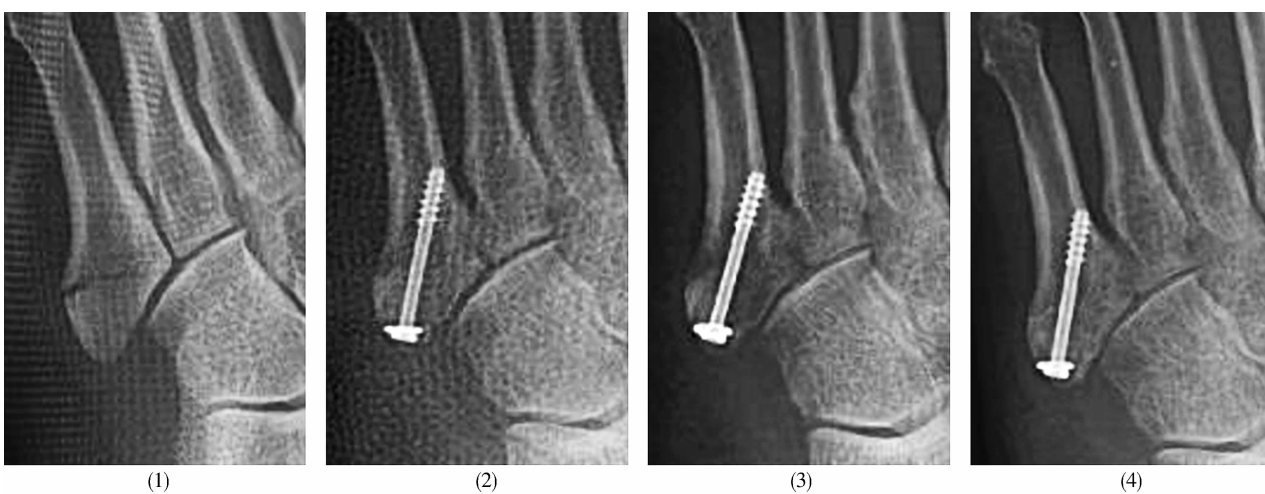

图 2　典型病例 2 X 线片

注：患者，女，39 岁，右侧第五跖骨基底部骨折，采用切开复位空心拉力螺钉内固定治疗，并以短腿石膏外固定，术后 4 周开始完全负重；(1)术前正位 X 线片示第五跖骨基底部骨折（Ⅰ区）；(2)术后 3 d 正位 X 线片示骨折复位满意；(3)术后 1 个月正位 X 线片示骨折无移位；(4)术后 12 个月正位 X 线片示骨折骨性愈合，关节间隙无狭窄。

表 2　2 组第五跖骨基底部骨折患者足部疼痛视觉模拟量表评分

组别	样本量/例	足部疼痛视觉模拟量表评分/($\bar{x}\pm s$,分)				F 值	P 值
		术后 1 个月	术后 6 个月	术后 12 个月	合计		
早负重组	34	3.1±1.6	1.7±2.3	0.1±0.4	1.6±1.3	0.951	0.000
晚负重组	34	3.5±2.6	2.3±2.8	0.2±0.6	2.0±2.0	5.739	0.000
合计	68	3.3±2.2	2.0±2.6	0.2±0.5	1.8±1.7	11.381[1)	0.000[1)
t 值		0.764	0.966	0.809	0.978[1)	F=1.813[2),	
P 值		0.457	0.348	0.423	0.432[1)	P=0.174[2)	

1）主效应的 F 值和 P 值;2）交互效应的 F 值和 P 值。

表 3　2 组第五跖骨基底部骨折患者美国足与踝关节协会踝与后足功能评分

组别	样本量/例	美国足与踝关节协会踝与后足功能评分/($\bar{x}\pm s$,分)				F 值	P 值
		术后 1 个月	术后 6 个月	术后 12 个月	合计		
早负重组	34	75.3±6.8	89.7±9.3	99.1±7.7	88.1±7.8	0.837	0.000
晚负重组	34	72.5±9.9	82.3±10.1	96.8±7.6	83.9±9.3	6.147	0.000
合计	68	73.9±8.4	86.0±9.7	98.0±7.7	86.0±8.6	13.916[1)	0.000[1)
t 值		1.354	3.143	1.240	2.018[1)	F=1.947[2),	
P 值		0.187	0.004	0.361	0.039[1)	P=0.159[2)	

1）主效应的 F 值和 P 值;2）交互效应的 F 值和 P 值。

3.2.4　并发症发生情况　2 组患者均未发生切口感染、骨折再移位等并发症。

4　讨　论

手术治疗第五跖骨基底部骨折可获得满意的临床疗效,但是术后何时负重行走,目前仍未形成共识[16-17]。建议制动 4 周后完全负重,主要考虑负重行走可导致骨折再移位,影响骨折愈合[18-22]。Torg 等[9]报道了 25 例第五跖骨基底部骨折,其中 15 例采用短腿石膏固定且 6~9 周内不负重,10 例石膏固定后允许早期负重,治疗后 7 周晚负重患者中 14 例骨折愈合,而早负重患者中只有 4 例骨折愈合,因此建议第五跖骨基底部骨折不应早期负重。Choi 等[22]报道 58 例第五跖骨基底部骨折,允许石膏固定 4 周后负重,所有骨折均愈合。

本研究中,所有患者的骨折均采用切开复位内固定术治疗,并辅以短腿石膏外固定。2 组均未发生骨折再移位和骨折不愈合,早负重组骨折部位骨吸收发生率低于晚负重组,AOFAS 踝与后足功能评分高于晚负重组。我们认为,这主要是因为:①骨折采用内固定治疗,骨折端可获得即刻稳定,早负重很少能引起骨折再移位及内固定失败;②早负重可以促进足踝部肌肉力量的恢复及骨折部位血液循环重建,有利于患者功能恢复;③早负重可以给骨骼一定的力学刺激,避免废用性骨萎缩及骨折部位骨吸收。

本研究的结果提示,第五跖骨基底部骨折采用切开复位内固定手术治疗后,无论早负重还是晚负重均可获得满意的临床疗效,而且安全性较高,但早负重更有利于足踝功能恢复、降低骨折部位骨吸收发生率。

参考文献

[1] MAGEED M,STEINBERG T,DRUMM N,et al. Internal fixation of proximal fractures of the 2nd and 4th metacarpal and metatarsal bones using bioabsorbable screws[J]. Aust Vet J,2018,96(3):76-81.

[2] 赵玉果,汤立新,叶向阳,等. 带线锚钉内固定治疗第五跖骨基底部撕脱骨折[J]. 中医正骨,2019,31(7):55-57.

[3] ZHAO J,YU B,XIE M,et al. Surgical treatment of zone 1 fifth metatarsal base fractures using the locking compression plate distal ulna hook plate[J]. J Am Podiatr Med Assoc,2017,107(5):369-374.

[4] XIE L,GUO X,ZHANG S J,et al. Locking compression plate distal ulna hook plate fixation versus intramedullary screw fixation for displaced avulsion fifth metatarsal base fractures:a comparative retrospective cohort study[J]. BMC Musculoskelet Disord,2017,18(1):405.

[5] VALKIER C,FALLAT L M,JARSKI R. Conservative versus surgical management of fifth metatarsal avulsion fractures[J]. J Foot Ankle Surg,2020,59(5):988-992.

[6] BAUMBACH S F,PRALL W C,KRAMER M,et al. Functional treatment for fractures to the base of the 5th metatarsal-influence of fracture location and fracture characteristics[J]. BMC Musculoskelet Disord,2017,18(1):534.

[7] AKIMAU P I,CAWTHRON K L,DAKIN W M,et al. Symptomatic treatment or cast immobilisation for avulsion frac-

tures of the base of the fifth metatarsal:a prospective,randomised,single-blinded non-inferiority controlled trial[J]. Bone Joint J,2016,98 - B(6):806 - 811.

[8]　MALLEE W H,WEEL H,VAN DIJK C N,et al. Surgical versus conservative treatment for high - risk stress fractures of the lower leg(anterior tibial cortex,navicular and fifth metatarsal base):a systematic review[J]. Br J Sports Med,2015,49(6):370 - 376.

[9]　TORG J S,BALDUINI F C,ZELKO R R,et al. Fractures of the base of the fifth metatarsal distal to the tuberosity. Classification and guidelines for non - surgical and surgical management[J]. J Bone Joint Surg Am,1984,66(2):209 - 214.

[10]　BEAN B A,SMYTH N,ABBASI P,et al. Biomechanical comparison of hook plate vs headless compression screw fixation of large fifth metatarsal base avulsion fractures[J]. Foot Ankle Int,2021,42(1):89 - 95.

[11]　O′MALLEY M,DESANDIS B,ALLEN A,et al. Operative treatment of fifth metatarsal jones fractures(zones Ⅰ and Ⅱ) in the NBA[J]. Foot Ankle Int,2016,37(5):488 - 500.

[12]　WU G B,LI B,YF Y. Comparative study of surgical and conservative treatments for fifth metatarsal base avulsion fractures(type Ⅰ) in young adults or athletes[J]. J Orthop Surg(Hong Kong),2018,26(1):230.

[13]　DINEEN H,MURPHY T D,MANGAT S,et al. Functional outcomes for nonoperatively treated proximal fifth metatarsal fractures[J]. Orthopedics,2017,40(6):e1030 - e1035.

[14]　王亦璁. 骨与关节损伤[M]. 4 版. 北京:人民卫生出版社,2007:1573 - 1575.

[15]　KITAOKA H B,ALEXANDER I J,ADELAAR R S,et al. Clinical rating systems for the ankle - hindfoot,midfoot,hallux,and lesser toes[J]. Foot Ankle Int,1994,15(7):349 - 353.

[16]　NISHIKAWA D,AIRES D F,SAITO G H,et al. Treatment of zone 1 fractures of the proximal fifth metatarsal with CAM - Walker boot vs hard - soled shoes[J]. Foot Ankle Int,2020,41(5):508 - 512.

[17]　LEE K T,KIM K C,YOUNG K W,et al. Conservative treatment of refractures after modified tension band wiring of fifth metatarsal base stress fractures in athletes[J]. J Orthop Surg(Hong Kong),2020,28(2):230.

[18]　VAN DIJK P A,BREUKING S,GUSS D,et al. Optimizing surgery of metaphyseal - diaphyseal fractures of the fifth metatarsal:a cadaveric study on implications of intramedullary screw position,screw parameters and surrounding anatomic structures[J]. Injury,2020,51(12):2887 - 2892.

[19]　WANG Y,GAN X,LI K,et al. Comparison of operative and non - operative management of fifth metatarsal base fracture:a meta - analysis[J]. PLoS One,2020,15(8):151.

[20]　CHAN J J,MOHAMADI A,KAISER P,et al. Factors influencing treatment recommendations for base of 5th metatarsal fractures in orthopaedic residency programs[J]. Foot Ankle Surg,2020,26(4):464 - 468.

[21]　BIZ C,ZAMPERETTI M,GASPARELLA A,et al. Early radiographic and clinical outcomes of minimally displaced proximal fifth metatarsal fractures:cast vs functional bandage[J]. Muscles Ligaments Tendons J,2017,7(3):532 - 540.

[22]　CHOI Y N,CHOI Y R,SEO J H,et al. Results of non - operative treatment of the zone Ⅰ,Ⅱ fifth metatarsal base fracture[J]. J Korean Foot Ankle Soc,2011,15(4):207 - 211.