

humerus specimens[J]. Int Orthop, 2016, 40(9): 1913–1918.

[14] 王明新,刘玉杰,何蔚,等. 同种异体皮质骨锚钉结合缝线桥技术修复肩袖损伤[J]. 中华医学杂志, 2012, 92 (25): 1747–1750.

WANG MX, LIU YJ, HE W, et al. Repair of rotator cuff tear by allogenic cortical bone anchor with suture bridge[J]. Zhonghua Yi Xue Za Zhi, 2012, 92(25): 1747–1750. Chinese.

[15] Frank RM, Romeo AA. Arthroscopic soft tissue reconstruction in anterior shoulder instability[J]. Arthroscopische, 2018, 47(2): 121–128.

[16] Gulati A, Dessouky R, Wadhwa V, et al. New concepts of radiologic preoperative evaluation of anterior shoulder instability: on-track and off-track lesions[J]. Acta Radiol, 2018, 59(8): 966–972.

[17] Itoi E. ‘On-track’ and ‘off-track’ shoulder lesions[J]. EFORT Open Rev, 2017, 2(8): 343–351.

[18] 周恩昌,殷浩,唐萍,等. 锚钉数量及位置对肩关节 Bankart 损伤修复强度影响的有限元分析[J]. 中国骨伤, 2018, 31(12): 1136–1139.

ZHOU EC, YIN H, TANG P, et al. Finite element analysis of the influence of anchorage number and location on Bankart repair strength of shoulder joint[J]. Zhongguo Gu Shang/China J Orthop Trauma, 2018, 31(12): 1136–1139. Chinese with abstract in English.

(收稿日期: 2020–10–13 本文编辑: 连智华)

· 病例报告 ·

双侧胫骨高位截骨术伴左侧延迟性 Takeuchi II 型
外侧合页骨折保守治疗 1 例

徐奎帅, 陈进利, 赵夏, 张益, 彭海宁, 赵海波, 苏炜良, 于腾波
(青岛大学附属医院运动医学科, 山东 青岛 266100)

关键词 胫骨; 截骨术; 骨折; 病例报告
中图分类号: R683

DOI: 10.12200/j.issn.1003-0034.2020.12.007

开放科学(资源服务)标识码(OSID):



Bilateral high tibial osteotomy with delayed Takeuchi type II lateral hinge fracture: a case report XU Kui-shuai, CHEN Jin-li, ZHAO Xia, ZHANG Yi, PENG Hai-ning, ZHAO Hai-bo, SU Wei-Liang, and YU Teng-bo. Department of Sports Medicine, the Affiliated Hospital of Qingdao University, Qingdao 266100, Shandong, China
KEYWORDS Tibia; Osteotomy; Fractures; Case reports

患者女性, 58 岁, 2019 年 3 月因“右膝关节疼痛 5 年, 左膝关节疼痛 1 年”入院, 于我院摄全下肢 X 线片提示双膝关节退行性病变(图 1a), 门诊拟“双膝关节退行性病变”收入院。查体: 双膝关节轻度内翻畸形, 双膝关节内侧间隙压痛, 右膝关节浮髌试验阳性, 左膝关节活动度 0°~100°, 右膝关节活动度 0°~115°, 双膝关节髌股研磨试验阳性, 肌力正常, 其他实验室检查均为阴性。术前完善相关检查检验, 排除手术禁忌。术前影像学测量指标: 左膝关节截骨间隙 9.3 mm。于入院后第 2 天在全身麻醉下行左膝关节开放楔形胫骨高位截骨(opening wedge high tibial os-

teotomy, OWHTO)联合 TomoFix 锁定钢板内固定术。术中双平面截骨, 根据术前下肢力线得出截骨所需纠正的角度, 用骨刀及撑开器撑开截骨间隙, 谨慎操作避免外侧皮质骨折, C 形臂 X 线机透视见力线满意及合页完整后用 TomoFix 锁定钢板固定。术后第 1 天床旁摄左膝关节正侧位 X 线片见外侧合页正常(图 1b)。术后 4 d 患者出院。术后 1 个月复查时, 膝关节正侧位 X 线片示: 左膝关节外侧合页骨折(图 1c)。考虑患者左膝关节延迟性 Takeuchi II 型外侧合页骨折。患者否认外伤史, 且未诉不适, 患肢屈曲活动可, 可负重行走, 考虑下肢力线角度未丢失, 骨折处较稳定, 断端出现骨痂愈合迹象, 嘱患者减少负重活动及支具保护等保守治疗, 逐月复查。术后 2 个月(图 1d)、3 个月(图 1e)、4 个月(图 1f)、6 个月(图

通讯作者: 于腾波 E-mail: ytb8912@hotmail.com
Corresponding author: YU Teng-bo E-mail: ytb8912@hotmail.com

1g)、7 个月(图 1h)复查左膝关节正侧位 X 线片或全下肢 X 线片未见骨折处位移,骨折处逐渐愈合。术后 7 个月,患者自诉左膝关节恢复良好,症状较前明显改善,右膝关节疼痛较前显著,患者手术意愿强烈,于 2019 年 10 月 5 日,在全身麻醉下行右膝关节 OWHTO 联合 TomoFix 锁定钢板内固定术。术中透视见力线满意,合页完整,术后嘱患者 6 周内拄双拐部分负重,术后 6 周逐渐负重。术后 3 d 膝关节正位 X 线片(图 1i)示:右膝关节内侧间隙较前增宽,外侧合页完整,未见骨折。右膝关节术后 1 个月(图 1j),3 个月(图 1k),6 个月(图 1l,1m)双膝关节正位 X 线片或全下肢 X 线片示:右膝关节胫骨高位截骨术后未见异常,左膝关节外侧合页骨折处骨折端愈合,双下肢力线正常。末次随访,患者双膝关节活动度良好,双膝可完全负重行走,未诉其他不适。

讨论

在膝关节骨性关节炎的中期,OWHTO 是缓解

膝关节疼痛、延缓膝关节退变的有效措施。既往 Mate 分析也表明,与单髁置换术中短期临床效果比较,胫骨高位截骨术治疗内侧间室骨关节炎是一种比较好的选择方式^[1]。而 OWHTO 术后最常见的并发症就是外侧合页骨折。既往文献统计,外侧合页骨折的发生率 15.6%~25.4%^[2-5]。既往研究发现,外侧合页骨折会导致截骨后胫骨初始不稳定,进而发生截骨部位微动增加、矫正度数丢失、截骨延迟愈合甚至不愈合等并发症的发生^[6],因此外侧合页骨折的预防及处理就显得尤为重要。

(1)外侧合页骨折的发生原因。在术中,Takeuchi I 型骨折形成的主要原因是截骨线过深,合页保留过窄,术中操作及人员配合出现偏差等;导致 II 型骨折的主要原因是截骨线过低,下方的皮质骨较脆,易导致向截骨线以远的骨折;导致 III 型骨折的原因是保留合页过宽,截骨深度不够,在撑开时导致经胫骨平台的骨折。既往研究发现,撑开间隙的过大^[7]与外



图 1 患者,女,58 岁,双侧胫骨高位截骨术伴左侧延迟性 Takeuchi II 型外侧合页骨折 **1a.** 术前下肢全长 X 线片示双膝关节退行性改变,内侧间室狭窄,内侧软骨磨损,伴骨赘生成 **1b.** 左膝关节术后第 3 天,左膝关节正位 X 线片见左膝关节胫骨高位截骨术后外侧合页完整,未见骨折 **1c.** 左膝关节开放楔形胫骨高位截骨术后 1 个月 X 线片示 Takeuchi II 型外侧合页骨折,骨折线由截骨处朝向胫骨远端,骨折端较稳定 **1d,1e,1f,1g.** 左膝关节胫骨高位截骨术后 2、3、4、6 个月 X 线片示骨折端稳定,骨痂逐渐长入,骨折处不断愈合

Fig.1 Female, 58-year-old, high tibial osteotomy on both sides with the left side of delayed Takeuchi II type lateral hinge fractures **1a.** Preoperative X-ray film of lower limb showed degenerative changes of both knees, medial compartment stenosis, medial cartilage wear and osteophyte formation **1b.** On the 3rd day after operation of left knee joint, X-ray film of left knee joint showed that high tibial osteotomy of left knee joint showed that lateral hinge was intact without fracture **1c.** One month after opening wedge high tibial osteotomy of the left knee joint, Takeuchi type II lateral hinge fracture was seen. The fracture line was from osteotomy site to distal tibia, and the fracture end was relatively stable **1d, 1e, 1f, 1g.** The X-ray films of the left knee joint at 2, 3, 4, 6 months after high tibial osteotomy showed that the fracture end was stable, the callus gradually grew in, and the fracture was healed continuously



图 1 患者,女,58 岁,双侧胫骨高位截骨术伴左侧延迟性 Takeuchi II 型外侧合页骨折 **1h**. 左膝关节术后 7 个月 X 线片示下肢力线位于胫骨粗隆右侧,与骨折前相比,过度纠正角度 1° ,未见明显外翻 **1i**. 右膝关节胫骨高位截骨术后 3 d 右膝关节正位 X 线片示内侧间隙较前增宽,外侧合页完整,未见骨折 **1j**. 右膝关节术后 1 个月,左膝关节术后 8 个月,膝关节正位 X 线片示双膝关节内侧间室较前增宽,左膝关节骨折处逐渐愈合,右膝关节合页完整 **1k**. 右膝关节术后 3 个月,左膝关节术后 10 个月,双膝关节正侧位 X 线片 **1l,1m**. 右膝关节术后 6 个月,左膝关节术后 13 个月,全下肢 X 线片及双膝关节正位 X 线片示双膝关节内侧间室较术前均增宽,力线正常,左膝关节骨折处愈合

Fig.1 Female,58-year-old,high tibial osteotomy on both sides with the left side of delayed Takeuchi II type lateral hinge fractures **1h**. X-ray film of the left knee showed that lower limb force line was located on the right side of tibial tuberosity at 7 months after the operation. Compared with that before the fracture,the over correction angle was 1° and no obvious valgus was found **1i**. Three days after high tibial osteotomy of the right knee,AP X-ray film of the right knee joint showed that the medial space was widened and the lateral hinge was complete,and no fracture was found **1j**. One month after the operation of the right knee joint and eight months after the operation of the left knee joint,the X-ray film of the knee joint showed that the medial compartment of both knee joints was widened,the fracture of the left knee joint gradually healed,and the hinge of the right knee joint was complete **1k**. Three months after operation of right knee joint and 10 months after operation of left knee joint,X-ray films of both knee joints were taken **1l,1m**. Six months after operation of right knee joint and 13 months after left knee joint operation,X-ray film of whole lower limb and anteroposterior X-ray film of both knees showed that the medial compartment of both knees was widened,the force line was normal,and the fracture site of left knee joint was healed

侧合页端断裂密切相关。在术后,延迟性合页骨折,可能由于术中隐匿性骨折未发现、患者体重较大且过早负重、不合适的功能锻炼甚至再次外伤等原因引起。Schröter 等^[8]研究证实随着术后负重时间延长,可能导致外侧铰链断裂。

(2)预防外侧合页骨折的措施及个人体会。预防术后外侧铰链骨折的措施及笔者体会如下:①术中合页保留合适的长度,以 1 cm 为宜。②合页位置位于干骺端,以导针指向腓骨头中上 1/3 或距外侧关节面 1.5 cm 为宜,位置不要过低,下方的皮质骨容易发生合页断裂的情况。③截骨成功后应缓慢撑开截骨间隙,也可防止术中出现铰链的断裂。④选择合适

配套的锯片,防止摆动幅度过大,导致合页的断裂。

⑤完善术前准备,若患者截骨间隙过大,则应警惕术中合页骨折风险。⑥术中保证截骨处后方皮质的完全截开,截骨前间隙与后间隙比例在 1:2 或 2:3,这样操作既可以预防合页的断裂又可保持正常的后倾角度。⑦坚强的内固定可有效保证截骨处的稳定性,选择合适的内固定材料既可保证术后负重的安全性,又是出现 I 类骨折时的有效补救措施。⑧完善术后护理,普及科学的功能锻炼方法,防止患者过早的完全负重,减少术后合页骨折的风险。⑨Tomofix 锁定钢板因具有较好的角度稳定性,对于稳定骨折可不做特殊处理,但需警惕术后骨折愈合延迟或不愈合,甚至矫正角度丢失的风险。⑩对于术中隐匿性骨折,笔者建议,若外侧铰链骨折的多种危险因素同时存在,术后可复查患肢膝关节 CT,对于隐匿性骨折的鉴别诊断和及时干预具有积极意义。

(3) 外侧合页骨折的处理。在术中,若出现 Takeuchi I 型骨折,因骨折端较为稳定,术中坚强的内固定(如 Tomofix 锁定钢板内固定)可以对外侧铰链断裂处起到加压作用,通过加压的方式使得骨折端贴合,利于术后愈合。若出现 Takeuchi II 型骨折,因骨折处不稳定,在坚强内固定加压的同时,笔者建议截骨处植骨,特别是截骨间隙较大的患者。若出现 Takeuchi III 型骨折,因属于关节内骨折,在复位后,考虑坚强的内固定及植骨也不能稳定胫骨平台处的骨折端,则需经外侧加用拉力螺钉保护,以免骨折移位产生。对于术中难以发现的骨折,应注意术后延迟性外侧铰链断裂。本例患者就属于术中透视未见外侧铰链断裂,术后 1 个月发现外侧铰链骨折,患者可部分负重行走,且未见明显外翻畸形(过度纠正<3°),因此建议患者减少负重活动,经保守治疗后外侧铰链断裂处及截骨处愈合良好。既往 Seung-Beom 等^[9]研究发现,未移位(<2 mm)外侧铰链断裂的患者经保守治疗可逐渐治愈,无须手术治疗。若术后出现患肢矫正过度导致外翻畸形明显(过度纠正>3°),患肢因外翻疼痛剧烈或内固定物的失效,笔者建议再次手术或翻修手术,术中坚强内固定以纠正畸形。另外,发生 Takeuchi II 型及 III 型骨折的患者,应根据具体情况适当延长完全负重的时间,定期复查患肢膝关节正侧位 X 线片,影像学发现骨痂形成才能完全

负重。

综上所述,本例患者双侧胫骨高位截骨术后随访 1 年,左侧膝关节延迟性 II 型外侧合页骨折在保守治疗后逐渐愈合,术后双膝关节症状较术前明显改善,患者术后恢复满意。针对外侧铰链骨折的发生原因,应采取积极的预防措施,以减少术后并发症的产生。

参考文献

[1] 付有伟,刘丙根,罗坚,等.单髁置换术与胫骨高位截骨术治疗膝关节内侧间室骨关节炎的 Meta 分析[J].中国骨伤,2018,31(12):1156-1163.
FU YW,LIU BG,LUO J,et al. Meta analysis of unilateral condylar replacement and high tibial osteotomy in the treatment of medial compartment osteoarthritis of the knee[J]. Zhongguo Gu Shang/China J Orthop Trauma,2018,31(12):1156-1163. Chinese with abstract in English.

[2] Seo SS,Kim OG,Seo JH,et al. Complications and short-term outcomes of medial opening wedge high tibial osteotomy using a locking plate for medial osteoarthritis of the knee[J]. Knee Surg Relat Res,2016,28(4):289-296.

[3] Martin R,Birmingham TB,Willits K,et al. Adverse event rates and classifications in medial opening wedge high tibial osteotomy [J]. Am J Sports Med,2014,42(5):1118-1126.

[4] Nelissen EM,van Langelaan EJ,Nelissen RG. Stability of medial opening wedge high tibial osteotomy:a failure analysis[J]. Int Orthop,2010,34(2):217-223.

[5] Ogawa H,Matsumoto K,Akiyama H. The prevention of a lateral hinge fracture as a complication of a medial opening wedge high tibial osteotomy:a case control study[J]. Bone Joint J,2017,99-B(7):887-893.

[6] Meidinger G,Imhoff AB,Paul J,et al. May smokers and overweight patients be treated with a medial open-wedge HTO? Risk factors for non-union[J]. Knee Surg Sports Traumatol Arthrosc,2011,19(3):333-339.

[7] Nakamura R,Komatsu N,Murao T,et al. The validity of the classification for lateral hinge fractures in open wedge high tibial osteotomy[J]. Bone Joint J,2015,97-B(9):1226-1231.

[8] Schröter S,Conser CE,Konstantinidis L,et al. High complication rate after biplanar open wedge high tibial osteotomy stabilized with a new spacer plate(Position HTO plate) without bone substitute[J]. Arthroscopy,2011,27(5):644-652.

[9] Seung-Beom Han,Yong In,Kwang Jun Oh,et al. Complications associated with medial opening-wedge high tibial osteotomy using a locking plate:a multi-center study[J]. J Arthroplasty,2019,34:439-445.

(收稿日期:2020-08-14 本文编辑:连智华)