

World Journal of *Clinical Cases*

World J Clin Cases 2022 February 6; 10(4): 1140-1456



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ABOUT COVER

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The WJCC is now indexed in Science Citation Index Expanded (also known as SciSearch®), Journal Citation Reports/Science Edition, Scopus, PubMed, and PubMed Central. The 2021 Edition of Journal Citation Reports® cites the 2020 impact factor (IF) for WJCC as 1.337; IF without journal self cites: 1.301; 5-year IF: 1.742; Journal Citation Indicator: 0.33; Ranking: 119 among 169 journals in medicine, general and internal; and Quartile category: Q3. The WJCC's CiteScore for 2020 is 0.8 and Scopus CiteScore rank 2020: General Medicine is 493/793.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: Hua-Ge Yin, Production Department Director: Xu Guo, Editorial Office Director: Jin-Lei Wang.

NAME OF JOURNAL

World Journal of Clinical Cases

ISSN

ISSN 2307-8960 (online)

LAUNCH DATE

April 16, 2013

FREQUENCY

Thrice Monthly

EDITORS-IN-CHIEF

Bao-Gan Peng, Jerzy Tadeusz Chudek, George Kontogeorgos, Maurizio Serati, Ja Hyeon Ku

EDITORIAL BOARD MEMBERS

<https://www.wjgnet.com/2307-8960/editorialboard.htm>

PUBLICATION DATE

February 6, 2022

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<https://www.wjgnet.com/bpg/GerInfo/288>

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<https://www.wjgnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>



Autogenous iliotibial band enhancement combined with tendon lengthening plasty to treat patella baja: A case report

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Author contributions: All authors contributed to the case conception and design; Zhu WH provided the valuable case and performed the operation; Data collection and analysis were performed by Tang DZ, Chen YM, and Pan JK; The first draft of the manuscript was written by Tang DZ and Liu Q, they are the co-first authors, and their contributions are equal; all authors commented on previous versions of the manuscript; all authors read and approved the final manuscript.

Informed consent statement: The patient has signed the informed consent and agreed to have his case included in the publication of the article.

Conflict-of-interest statement: There is no conflict of interest between the authors of this report.

CARE Checklist (2016) statement: The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

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Abstract

BACKGROUND

Patella baja is a severe complication after knee injury or surgery, resulting in pain and impaired movement. This disorder is also a substantial challenge for orthopaedic surgeons. Currently, no consensus exists regarding the gold standard management of patella baja. If not appropriately treated, significant dysfunction of the knee joint will occur.

CASE SUMMARY

A 46-year-old man with a left patellar fracture was treated with tension band fixation at a local hospital. He had undergone a second operation at the same hospital because of limited knee flexion 6 mo after surgery. Unfortunately, the patellar tendon was ruptured. The patellar tendon was subsequently repaired using an ipsilateral semitendinosus tendon. Two years later, the patient presented to our department with knee pain and loss of range of motion. Autogenous iliotibial band (ITB) enhancement combined with sagittal tendon lengthening plasty was used to improve the symptoms of the knee joint. The patient was followed up for 2 years. The knee joint function of the patient returned to the normal level.

CONCLUSION

We successfully treated patella baja using autogenous ITB enhancement combined with sagittal tendon lengthening plasty.

Key Words: Patella baja; Tendon lengthening; Iliotibial band; Patellar fracture; Case report

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Country/Territory of origin: China**Specialty type:** Orthopedics**Provenance and peer review:**

Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind**Peer-review report's scientific quality classification**

Grade A (Excellent): 0

Grade B (Very good): 0

Grade C (Good): C

Grade D (Fair): 0

Grade E (Poor): 0

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Received: March 14, 2021**Peer-review started:** March 14, 2021**First decision:** April 23, 2021**Revised:** November 15, 2021**Accepted:** December 7, 2021**Article in press:** December 7, 2021**Published online:** February 6, 2022**P-Reviewer:** Yukata K**S-Editor:** Gong ZM**L-Editor:** Kerr C**P-Editor:** Gong ZM

Core tip: Patella baja combined with knee dysfunction can be observed in patients with patellar trauma. If not properly managed, joint stiffness and patellofemoral arthritis will occur, seriously affecting quality of life. Various therapeutic approaches are available, but no consensus exists regarding which is the best surgical approach. In this case report, we used our approach to treat patella baja using autogenous iliotibial band enhancement combined with tendon lengthening plasty to restore knee function with remarkable results.

Citation: Tang DZ, Liu Q, Pan JK, Chen YM, Zhu WH. Autogenous iliotibial band enhancement combined with tendon lengthening plasty to treat patella baja: A case report. *World J Clin Cases* 2022; 10(4): 1255-1262

URL: <https://www.wjgnet.com/2307-8960/full/v10/i4/1255.htm>

DOI: <https://dx.doi.org/10.12998/wjcc.v10.i4.1255>

INTRODUCTION

Patella baja is a condition in which the patella is positioned abnormally low relative to the femoral trochlea. Patella baja is normally classified into three types: congenital acquired and mixed[1]. Although the exact pathological mechanism of acquired patella baja remains unclear, several contributing factors have been reported, such as cicatricial hyperplasia of the patellar tendon after total knee arthroplasty, complete resection of the infrapatellar fat pad, chronic injury of the femoral quadriceps, and long-term immobilization after knee surgery[2-4].

Knee pain and dysfunction are the main clinical manifestations of acquired patella baja. If not addressed properly, joint stiffness and patellofemoral arthritis will occur, significantly affecting quality of life[5]. In contrast to conservative treatments, timely and effective surgical interventions play a key role in improving knee function. Although many surgical procedures have been attempted to manage this pathology[6-10], no consensus exists regarding which is the best option. In this case report, we used our method to treat patella baja using autogenous iliotibial band (ITB) enhancement combined with tendon lengthening plasty.

CASE PRESENTATION

Chief complaints

A 46-year-old man was admitted to our hospital because of left knee pain and loss of range of motion (ROM) for 2 years.

History of present illness

The patient had a left patellar fracture and was treated with tension band fixation at a local hospital 2 years prior. He had undergone a second operation at the same hospital because of limited knee flexion 6 mo after the surgery. The surgeon removed the internal fixation and performed manipulation under anaesthesia. Unfortunately, the patellar tendon was ruptured. The patellar tendon was subsequently repaired using an ipsilateral semitendinosus tendon.

History of past illness

No remarkable personal and family history.

Personal and family history

No special personal and family history.

Physical examination

Physical examination on admission revealed a longitudinal surgical scar of approximately 15 cm in length on the left knee joint, without obvious skin damage or ulceration. The patient presented with a lameness gait and pain in the knee, left quadriceps atrophy, and knee flexion limited by 45°. The Lysholm score and Interna-

tional Knee Documentation Committee (IKDC) score were 50 and 40, respectively.

Laboratory examinations

The laboratory findings were normal.

Imaging examinations

The patient was diagnosed with patella baja using a lateral-view radiograph of his left knee (Figure 1A–1C). Magnetic resonance imaging (MRI) further demonstrated that the patellar tendon was contracted and thickened (Figure 1C).

FINAL DIAGNOSIS

The final diagnosis was left patella baja and post-traumatic knee dysfunction.

TREATMENT

We used our method to treat patella baja using autogenous ITB enhancement combined with tendon lengthening plasty.

Surgical procedures and methods

A tourniquet was placed on the left thigh, with the patient in the supine position. Manipulation under anaesthesia was performed. Arthroscopic examination found a large amount of scar tissue and synovial hyperplasia in the joint. Although extensive arthrolysis was then performed by debriding fibrotic scar tissue in the suprapatellar bursa, medial recess, lateral recess, and intercondylar fossa, the ROM of the knee joint was 0°–65° (Figure 2A), and the patellar mobility was not significantly improved. Therefore, open surgery to lengthen the patellar tendon was conducted.

The approach was made along the original incision extending from 5 cm above the superior pole of the patella to the tibial tubercle (Figure 2B). After removing scar tissue surrounding the patella and patellar tendon, a minor increase in ROM was observed. The patellar tendon was subsequently freed and prepared for lengthening.

The length of the patellar tendon was approximately 35 mm (Figure 3A). The medial patellar insertion and lateral tibial insertion of the patellar tendon were carefully preserved when splitting along the midline (Figure 3B). Next, the patella was overturned upwards with the knee in 90° of flexion to assess the tendon length. The distance to be prolonged for the patient was approximately 60 mm, and the overlapping distance of the two free tendon ends was approximately 10 mm (Figure 3B). An ultrabraid suture (#2; Smith & Nephew, Andover, FL, USA) was used to overlap the tendon ends in a whipstitch fashion. To enhance the reconstructed patellar tendon, a 60 mm ITB graft was harvested (Figure 4A). The ITB graft was first fixed at the proximal and distal insertion of the patellar tendon by two TWINFIX Ti 3.5 mm suture anchors (Smith & Nephew) (Figure 3C), and then the graft and patellar tendon were sutured together using ultrabraid sutures. The length of the graft was calculated to avoid excess. Three MB66 polyester sutures (#5; Ethicon) were passed through the tibial and patellar bone tunnels as cerclage to avoid high tension when flexing the knee (Figure 4B). The ROM of the knee improved to 100°. Intraoperative fluoroscopy showed that the height of the patella was significantly recovered, with a Carton index of 1.0. After rinsing the wound thoroughly, it was closed normally, and drainage was left.

OUTCOME AND FOLLOW-UP

The patient was allowed partial weight-bearing using crutches with hinged knee brace protection on postoperative day 1. Straight-leg raises, ankle pump exercise and continuous passive motion were started within the first week after surgery. The initial ROM was limited between 0° and 15° for the first week after the procedure. An increment of 15° was allowed every week, and the ROM was increased to 90° by 6 wk. Full weight-bearing and unrestricted ROM were allowed after 2 mo, and the brace was discontinued after 3 mo.

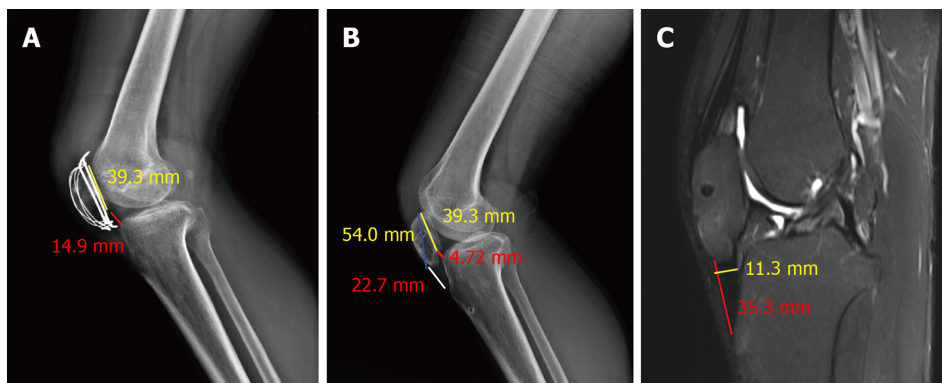


Figure 1 Preoperative lateral radiograph of the left knee and measurement of the patellar height. A: Before the second operation, the fracture healed, and the Caton–Deschamps index was 0.38; B: Before the third operation. The ratio of the red dotted line and yellow dotted line indicates that the Caton–Deschamps index was 0.12, and the ratio of the white dotted line to the blue dotted line indicated that the Insall–Salvati index was 0.42; C: The contracted patellar tendon is approximately 35.0 mm in length and 11.3 mm in thickness.



Figure 2 Arthroscopic release measurements were followed by range of motion (ROM) measurements and open surgery. A: ROM of the knee joint after arthroscopic release was slightly improved compared with the preoperative ROM; B: The approach was made from 5 cm above the superior pole of the patella to the tibial tubercle. A periosteal elevator (black arrow) was used to mobilize the contracted patellar tendon (white star) and identify its medial and lateral margins.

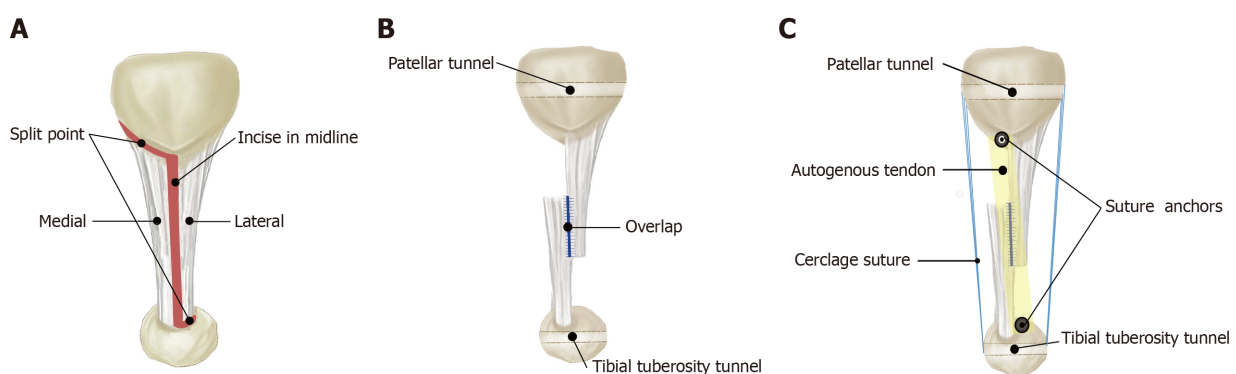


Figure 3 Schematic diagram of the lengthening method. A: The patellar tendon was longitudinally split along the midline while preserving the medial patellar insertion and the lateral tibial insertion of the patellar tendon (red line); B: Ultrabraid sutures were used to overlap the two tendon-free ends in a whipstitch fashion (blue line); C: The reconstructed patellar tendon was further strengthened using an iliotibial band graft (yellow area), which was fixed with two suture anchors (black circles), and suture cerclage was used to decrease tension (light blue line).

The postoperative radiograph showed that the patellar height was almost normal (Figure 5). The patient was followed up for 2 years. At the final follow-up, the ROM of his knee was 0° to 120° (Figure 6). Additionally, the Lysholm score and IKDC score improved to 92 and 86, respectively.

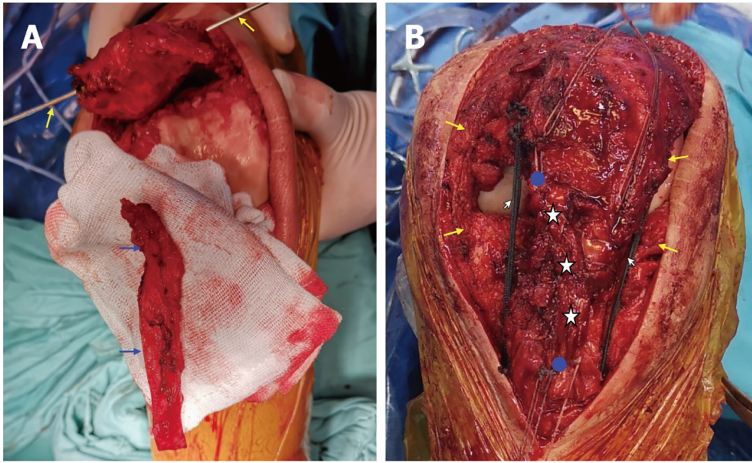


Figure 4 Intraoperative view of patellar tendon lengthening. A: The Kirschner wire was used to drill a bone tunnel of the patella (thin yellow arrow), and the iliotibial band (ITB) graft was harvested to strengthen the reconstructed patellar tendon (blue arrow); B: Intraoperative view after patellar tendon reconstruction and ITB enhancement. Medial and lateral scar tissue surrounding the patellar tendon were removed (yellow arrow). The ITB graft (white star) was fixed with suture anchors (blue circle). Three MB66 polyester sutures were used as cerclage to decrease tension (white arrow).

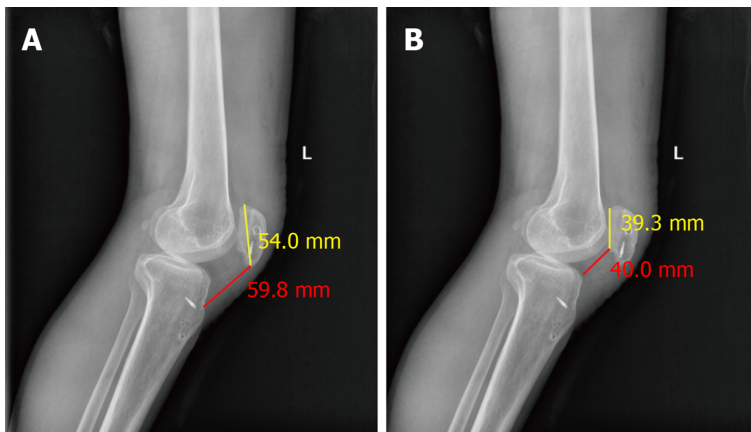


Figure 5 Radiographic image of the left knee postoperatively. A: The Insall–Salvati index is 1.1; B: The Caton–Deschamps index is 1.0.

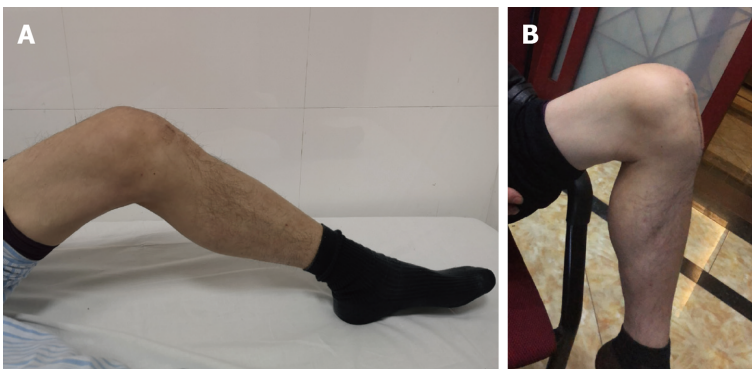


Figure 6 Comparison of the knee range of motion. A: Preoperative range of motion (ROM) is approximately 0°–45°; B: The ROM improved to 0°–120° at the last follow-up.

DISCUSSION

Patella baja is a severe complication after knee injury or surgery, resulting in pain and impaired movement. The specific aetiology of this disorder remains unknown. Currently, no consensus exists regarding the gold standard management of patella baja. We have successfully treated patients with a history of multiple knee surgeries.

Notably, our case had severe scar hyperplasia in the knee and contracture of the patellar tendon, which was of poor quality. The combination of patellar tendon lengthening and ITB enhancement to treat patella baja was suitable for this patient. Additionally, this treatment does not cause additional surgical trauma. Previous studies have attempted various methods to treat patella baja. In *et al*[8] used the classic Ilizarov technique to prolong the patellar tendon. Although the symptoms of the patient were considerably improved, the affected limb must be fixed for 3 mo, increasing the risk of joint stiffness. The modified Z-shaped plasty used by Guido *et al* [10] was a successful technique, but these patients did not have rupture of the patellar tendon and did not undergo patellar tendon surgery; thus, the patellar tendon was of relatively good quality. Modified Z-plasty would not be suitable for these patients. Bruhin *et al*[7] connected the patellar tendon with the quadriceps femoris surface using a transplanted tendon. Although this method does not affect tendon stress distribution and blood supply, it may cause certain restrictions on the quadriceps femoris. Additionally, transposition of the tibial tuberosity is a common technique to address patella baja[6,9]. However, complications were observed such as avulsion of the tibial tubercle and rupture of the patellar tendon. Judet's quadriceps muscle is the modality applied to describe a surgical procedure of the quadriceps muscle to improve knee flexion in severely ankylosed knees[11,12]. Although Judet's technique of disinsertion and muscle sliding is a useful technique in fixed knee extension contracture, it has an obvious disadvantage of a long incision and major invasiveness. Here, we reported a complex case of patella baja. A detailed and individualised surgical plan was customised preoperatively: arthroscopic arthrolysis, extensive resection of hyperplastic scar tissue, sagittal Z-plasty for patellar tendon lengthening, autogenous ITB transplantation for enhancement, and suture cerclage for decreased tension. Arthroscopic surgery to treat knee stiffness has been reported with satisfactory results [13,14]. At the beginning of the operation, we performed arthrolysis on the patient's knee joint under arthroscopy. However, the ROM was not obviously promoted after arthroscopic release; thus, we converted to open surgery. After thoroughly debriding the scar tissue around the patella and patellar tendon, the patellar tendon was equally split and overlapped to ensure a sufficient length when flexing the knee at 90°. To use the contracted patellar tendon more accurately, before surgery, the patellar tendon was evaluated and measured on MRI. After thorough debridement during the operation, the patellar tendon was measured again and compared with the preoperative measurements. Notably, the insertions of the patellar tendon at the patella and tibial tuberosity were well preserved, benefiting the mechanical properties and blood supply of the tendon. Furthermore, we used an autogenous ITB graft to strengthen the lengthened patellar tendon. Autogenous graft transplantation can not only provide mechanical enhancement but may also promote tendon healing[15-17]. Intraoperatively, ITB is used for patellar tendon enhancement, which will not cause additional surgical trauma. Additionally, considering that high-performance suture materials provide better stability[18], we passed three MB66 sutures as cerclage in the bone tunnels to reduce the tension. This suture cerclage may decrease the risk of rupture after surgery.

We analysed the possible reasons for patella baja of our patient. First, the local orthopaedic surgeon left a relatively long end of the K-wire at the index operation. The long end of the K-wire might irritate the patellar tendon and quadriceps tendon, making rehabilitation challenging[19,20]. Second, it is a common phenomenon that patients who were treated at county-level hospitals did not have a systematic rehabilitation protocol in China. Presently, our government is strengthening the construction of a community rehabilitation medical centre. Finally, the patellar tendon ruptured when performing manipulation under anaesthesia during the second surgery. This may be related to the insufficient release of intra-articular adhesion.

This case had several limitations. First, the harvested ITB may cause pain in the graft harvest site, which depends on the intraoperative condition and surgeon's experience. Second, more cases are needed to verify the effectiveness of our method. Third, the follow-up was short.

Importantly, much knowledge was gained from the patient's prior surgery. We reviewed the patient's medical records and radiological data, which helped to plan the detailed surgical procedures and avoid possible intraoperative pitfalls.

CONCLUSION

We successfully treated patella baja using autogenous ITB enhancement combined

with sagittal tendon lengthening plasty. The repair and enhancement of the patellar tendon were achieved effectively and is a worthwhile approach for patients who have had multiple knee surgeries.

ACKNOWLEDGMENTS

We thank our patient for consenting to have his case presented and published.

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