



Case report

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Lowering of the Patella – Prevention and Treatment of a Rare Complication During Leg Lengthening: A Case Report

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Abstract

Background. Changes in the level of the patella position are a well-known complication of knee replacement, reconstruction of the anterior cruciate ligament, high tibial osteotomy and consequences of injuries. However, this problem has not been disclosed in the literature in relation to distraction osteogenesis using the Ilizarov method.

The aim of the study is to describe such a rare iatrogenic complication as patella baja during limb lengthening by the Ilizarov method using a clinical case as an example.

Case description. In 2017, a 17-year-old teenager was injured in a head-on collision of cars at high speed. The patient was diagnosed with an open fracture of the left femur and fibula and tibia of the left leg. He was treated in another clinic using the Ilizarov apparatus for osteosynthesis of the femur, tibia and proximal osteotomy of the tibia to move the bone to fill the distal bone defect. At the end of the treatment, the patient had a moderate limitation of the knee flexion (180-80°). In 2018, the patient was admitted to our clinic due to osteomyelitis at the level of the consolidated fracture. A new resection of the osteomyelitis lesion and proximal osteotomy for bifocal osteogenesis were performed. During the treatment, limitation of knee flexion (180-120°) was developed and radiographic signs of low position of the patella were obtained. Given the progression of patella baja (the Caton-Deschamps index = 0.51), we were forced to return the patient to the operating room to restore the correct height of the patella.

Conclusions. The presented clinical case emphasizes the need for a more thorough assessment of the patella height after surgical treatment on the proximal tibia using the Ilizarov method. It is also noted that it is important to conduct a control MRI, which allows for a more detailed study of the initial position of the anterior tibial tubercle. In our case, early detection of complications allowed us to achieve complete recovery without any consequences.

Keywords: patella baja, tibial tubercle, patellar tendon lengthening, Z-plasty, Ilizarov method, bone transport.

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Patella baja надколенника – профилактика и лечение редкого осложнения при удлинении нижней конечности: клинический случай

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Реферат

Актуальность. Изменение уровня положения надколенника является хорошо известным осложнением при эндопротезировании, реконструкции передней крестообразной связки, высокой остеотомии большеберцовой кости и последствиях травм. Однако до сих пор в литературе не была раскрыта данная проблема применительно к дистракционному остеогенезу по методу Илизарова.

Цель исследования — на примере клинического случая описать такое редкое ятрогенное осложнение, как *patella baja* при удлинении конечности по методу Илизарова.

Описание клинического случая. В 2017 г. 17-летний подросток получил травму при лобовом столкновении автомобилей на высокой скорости. У пациента был диагностирован открытый перелом левой бедренной кости и обеих костей левой голени. Он проходил лечение в другой клинике с использованием аппарата Илизарова для остеосинтеза бедренной кости, костей голени и проксимальной остеотомии большеберцовой кости для перемещения кости с целью заполнения дистального дефекта кости. В конце лечения у пациента наблюдалось умеренное ограничение амплитуды сгибания конечности в коленном суставе (180–80°).

В 2018 г. пациент поступил в нашу клинику по поводу остеомиелита на уровне консолидированного перелома. Были выполнены новая резекция очага остеомиелита и проксимальная остеотомия для бифокального остеогенеза. Во время лечения у пациента развилось ограничение сгибания колена (180–120°) и были получены рентгенологические признаки низкого стояния надколенника. Учитывая прогрессирование *patella baja* (коэффициент Катона–Дешама составил 0,51), мы были вынуждены провести еще одно хирургическое вмешательство, чтобы восстановить правильную высоту надколенника.

Заключение. Представленный клинический случай подчеркивает необходимость более тщательной оценки высоты стояния надколенника после операции на проксимальном отделе большеберцовой кости по методу Илизарова. Также важно проводить контрольное МРТ-исследование, позволяющее более подробно изучить исходное положение переднего большеберцового бугорка. В нашем случае раннее выявление осложнений позволило добиться полного выздоровления без каких-либо последствий.

Ключевые слова: *patella baja*, большеберцовый бугорок, удлинение сухожилия надколенника, Z-пластика, метод Илизарова, бифокальный остеогенез.

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INTRODUCTION

Various complications have been described relative to bone lengthening or bone transport treatment with the Ilizarov method [1, 2, 3, 4, 5, 6]. In contemporary literature, no one described the complications involving patella height. The patella baja, also referred as patella infera, is a condition involving decreased patellar height [7, 8, 9, 10]. It can be congenital or can be acquired as the result of a traumatic injury or a surgical procedure [11, 12, 13, 14, 15, 16, 17].

Aim of the study – to describe such a rare iatrogenic complication as patella baja during leg lengthening with the Ilizarov method using a clinical case as an example.

CASE PRESENTATION

We present the case of a 17-year-old patient who suffered an open fracture of the left femur and left leg following a motorcycle accident in January 2017 (Figure 1).

Initially the treatment was begun in another hospital. An external fixator for damage control orthopedics (DCO) was applied, for both femur and tibia. Surgical debridement of soft tissue and bone was performed to the distal third of the leg. A flap was set up to cover the loss of substance as soon as the inflammation rates returned to normal. After 4 weeks, the temporary leg external fixator was converted with the Ilizarov fixator. An antegrade bifocal bone transport with proximal metaphyseal osteotomy was chosen to fill a 10 cm bone defect (Figure 2).

At the end of the bone transport, a further revision of the docking site was carried out. The femur fixator was removed after 7 months while the leg fixator was removed after 1 year after trauma.

At the end of the treatment, the patient showed modest limitation of knee flexion (ROM 180-80°).

In October 2018, he was evaluated at our hospital for clinical signs of infection with the presence of sinus and drainage in the distal third of the left leg. After clinical evaluation it was requested FDG PET-CT (fluoro-D-glucose positron emission computed tomography), which highlighted and confirmed

the focus of osteomyelitis in correspondence with the previous docking site (Figure 3). To complete the diagnosis, X-ray and CT scan of the leg was performed (Figure 4).



Figure 1. X-rays show a diaphysis fracture of the right femur (a) and fracture and bone defect of the distal third of the tibia and fibula (b)

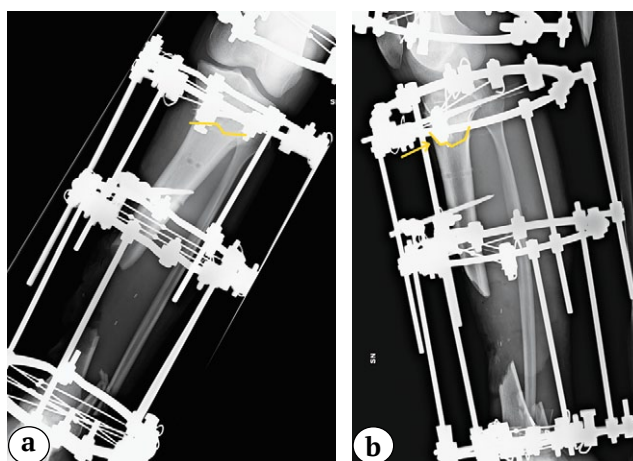


Figure 2. AP and lateral X-rays showing first Ilizarov fixator: a – a yellow line makes evident the level of proximal metaphyseal osteotomy; b – a yellow arrow indicates the distal part of tibial tubercle

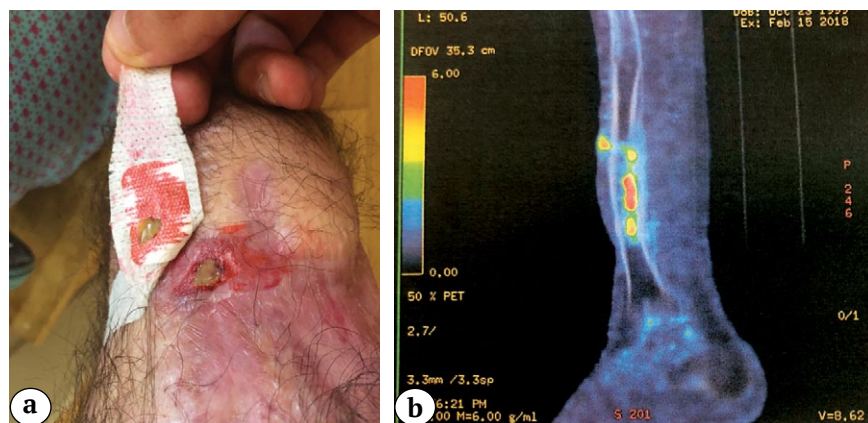


Figure 3. Clinical signs of infection with sinus and drainage (a); FDG PET-CT shows and confirms infection with uptake at the level of previous docking site (b)



Figure 4. Lateral X-ray (a) and CT scan (b) before second Ilizarov fixator: a – purple and blue lines show the Caton-Deschamps ratio (lower limit of 0.60). A white oval shows area of tibial tubercle; b – purple lines delimit atypical extension of the patellar tendon

The strategies of treatment were to resect the osteomyelitis focus and perform a new proximal metaphyseal tibial osteotomy for antegrade bifocal bone transport with the Ilizarov technique (Figure 5). During the lengthening process, the patient experienced increasing pain, the flexion was

limited to 120°. X-rays of the patella infera with the Caton-Deschamps ratio negative of 0.51 (normal = 1.3 ± 0.6) were obtained (Figure 6).

We decided to bring the patient back to the operating room to perform revision of tibial tubercle e patellar tendon. In the operative room, we stabilized first the patella with two transeverse 1.8 mm olive K-wires connected with a half-ring and interconnection with three threaded rods to proximal tibial ring. Attempting to lift the patella proximally, we detected a subcutaneous tension distal to the proximal tibial ring. We tried percutaneous partial tenotomy of the patellar tendon with 11-blade scalpel without any positive result. At this point we decided to inspect the patellar tendon through an incision of 10 cm. We noted atypical presence of the patellar tendon in continuity with the distal fragment of osteotomy crossing longitudinally the whole regenerated site. We performed a lengthening of the patellar tendon with Z-plasty to restore the regular height of the patella. The tendon was sutured in knee flexion (Figure 7).

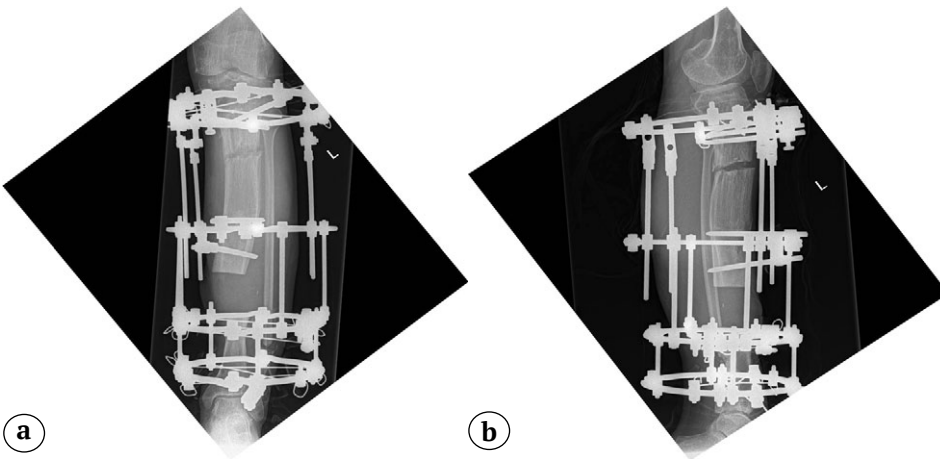


Figure 5. AP (a) and lateral X-rays (b) at the beginning of bone transport. Note the patella height continues to get worse (b)

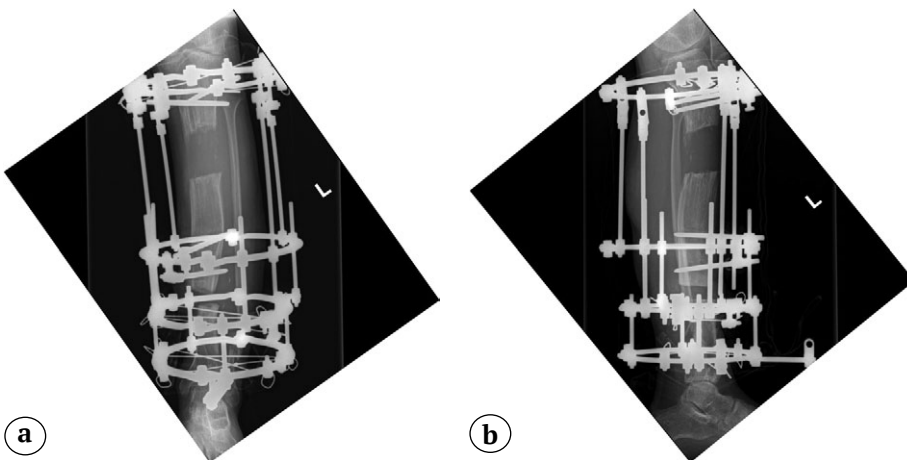


Figure 6. AP (a) and lateral X-rays (b) close to the end of bone transport when lowering of the patella was clinically evident (the Caton-Deschamps ratio negative)

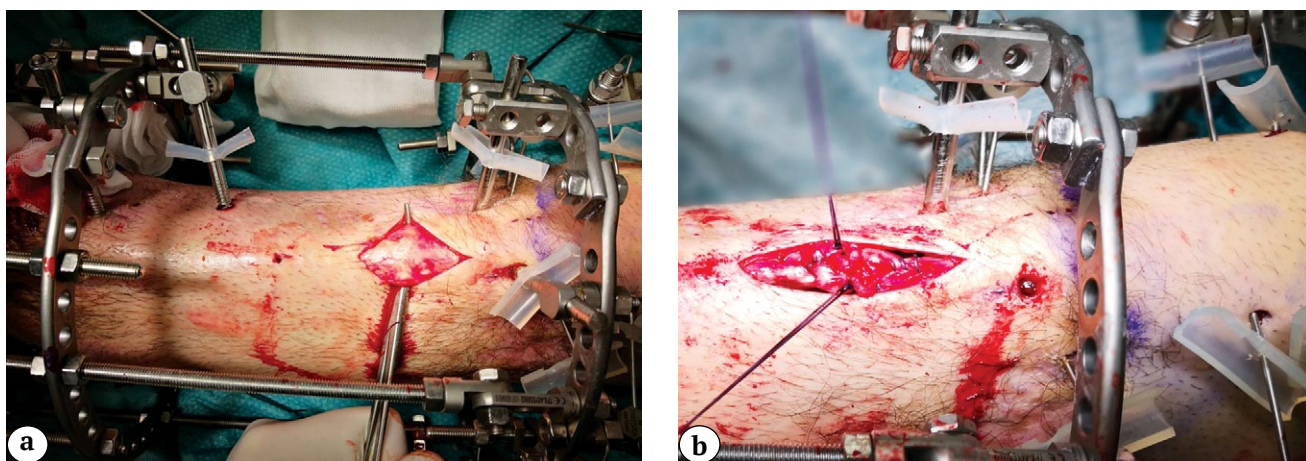


Figure 7. Surgical field views. Atypical length of the patellar tendon in continuity with the distal fragment of transported bone (a). Z-plasty of patellar tendon to restore the correct patella height. On the right side of the picture, K-wires blocking the patella at the correct height are observed (b)

The clinical improvement was immediate with a prompt recovery of knee flexion (ROM 180-90°) and the Caton-Deschamps ratio ranges from 0.51 to 0.83. The external fixator was removed in March 2020 after consolidation was achieved at the docking site

and regenerated bone. The Caton-Deschamps ratio comparable to the post-operative one confirmed the correct patellar height (Figure 8). The patient returned to his usual activities of daily living without any sequelae affecting the knee.

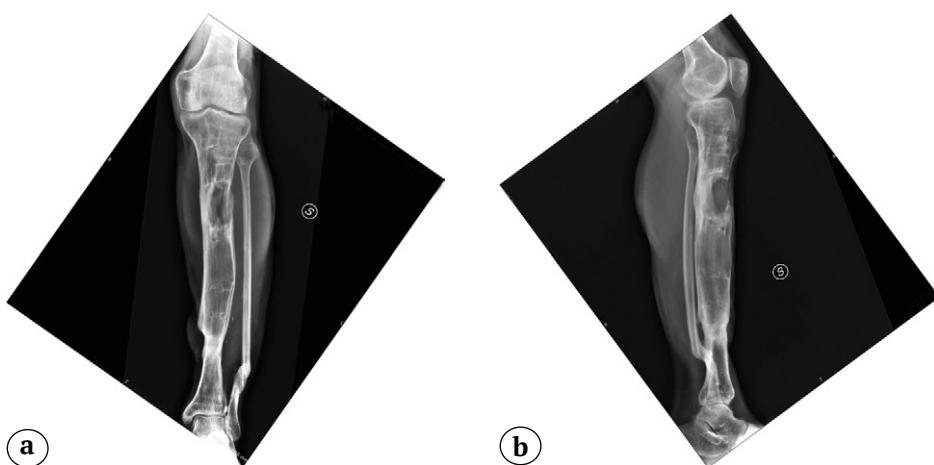


Figure 8. AP (a) and lateral X-rays (b) after Ilizarov fixator removal:
a – note healing of regenerated bone and docking site;
b – restoring of the correct patella height (the Caton-Deschamps ratio of 0.83)

DISCUSSION

When dealing with osteotomy surgery, some rules must be considered. In deformity cases the osteotomy level should be performed in accordance with the CORA strategy [18].

A further aspect to consider are osteotomies in relation to tendon insertions. In knee surgery, high tibial osteotomy interventions aim to modify the axis but being proximal to the tibial tubercle, they modify its height and length of the tendon [19]. Meticulous knowledge of anatomy can prevent complications [20]. Furthermore, when performing an osteotomy, anatomical interindividual variations must be taken into account [21, 22].

Considering all these elements when approaching leg lengthening treatment without deformity, the choice of osteotomy site should be performed in the metaphyseal region. The reasons are to exploit the great regenerative potential of both bone and soft tissue and to avoid modifying the extensor mechanism [4, 23, 24]. This principle must be even more stressed when planning treatment for large bone defects.

In addition to these factors, as we have appreciated in this case report, previous interventions must also be considered. Reevaluating the case presented, the first osteotomy for bone transport was performed at the upper limit of the metaphyseal area of the

tibia and, comparing the evolution of the Caton-Deschamps ratio, partially involved the tibial tubercle from the beginning.

In fact, reviewing the preoperative X-ray and CT scan, the patella showed values at the lower limits of the Caton-Deschamps ratio, and the CT showed an anomalous anatomy of the patellar tendon with extension well beyond the tibial tubercle.

Among various complications related to treatment with the Ilizarov apparatus, we have mentioned joint stiffness [25]. This may have been a confounding factor in the approach to the second proximal tibial osteotomy for bone transport.

Although the osteotomy level was performed in the full metaphyseal region and well below the hypothetical tibial tubercle, it was not possible to avoid a further increase in patellar lowering.

The strict clinical and radiographic monitoring during the treatment made it possible to identify the patella baja and to intervene promptly to restore an adequate patellar height as well as avoid any type of sequelae.

Complications during treatment with the Ilizarov method are well known and have already been the subject of case series reviews [1, 2, 3, 4, 5, 6]. As it has been already well described by D. Paley, complications

during the treatment can be divided into problems and obstacles [3].

In this case report, lowering of the patella certainly represented an obstacle, because of which it was necessary to return the patient to the operating room.

Despite this deviation from the treatment plan, the Z-plasty technique proved effective in correctly resting the patellar height [8]. Furthermore, the possibility of stabilizing the patella and fixing it with the elements of the Ilizarov apparatus contributed to the consolidation, confirming the versatility of the method [26].

CONCLUSIONS

When facing the limb lengthening treatment, it is certainly recommended to carry out serial outpatient controls, so to evaluate any onset of complications and promptly resolve them.

The level of osteotomy plays a fundamental role in the success of the treatment not only to obtain good quality of osteogenesis but also to avoid involving tendon insertions.

We recommend a preoperative MRI examination in particular in such cases presenting joint stiffness already treated with proximal tibial osteotomy for leg lengthening.

DISCLAIMERS

Author contribution

All authors made equal contributions to the study and the publication.

All authors have read and approved the final version of the manuscript of the article. All authors agree to bear responsibility for all aspects of the study to ensure proper consideration and resolution of all possible issues related to the correctness and reliability of any part of the work.

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Ethics approval. Not applicable.

Consent for publication. Written consent was obtained from the patient for publication of relevant medical information and all of accompanying images within the manuscript.

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ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

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Все авторы сделали эквивалентный вклад в подготовку публикации.

Все авторы прочли и одобрили финальную версию рукописи статьи. Все авторы согласны нести ответственность за все аспекты работы, чтобы обеспечить надлежащее рассмотрение и решение всех возможных вопросов, связанных с корректностью и надежностью любой части работы.

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