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Experience with open lavsanoplasty of the tibial collateral ligament

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Abstract

Introduction The tibial collateral ligament (TCL) is one of the major ligaments of the knee and designed to counteract valgus forces. Tibial collateral ligament injury can be treated conservatively with prolonged immobilization and limited weight-bearing on the injured limb. Clinical experience and a high complication rate after conservative treatment indicate the need for surgical intervention to restore the integrity of the TCL. **The purpose** is to demonstrate a successful management of a patient with ruptured TCL of the right knee joint and substantiate the priority of surgical treatment in the case. **Material and methods** A clinical case is reported and a brief literature analysis on the topic provided. The experience with open lavsanoplasty used for a patient with rupture of the TCL resulting from dislocated tibia is presented. The effectiveness of treatment was assessed radiologically and physically for the limb functionality and ROM in the knee joint. **Results and discussion** Open lavsanoplasty performed for the TCL injury resulted in complete restoration of the limb function and anatomical integrity of the ligament. The good result persisted after the removal of the metal construct. The method allowed us to avoid complications being typical for conservative treatment: medial instability of the knee joint and deforming arthritis, and showed the advantages over other surgical treatments used to regain the integrity of the TCL. **Conclusion** Open lavsanoplasty of the TCL used as the patented technique facilitated complete recovery the injured limb, the functionality, less risk of complications providing a good clinical result.

Keywords: tibial collateral ligament, lavsanoplasty, knee injury, trauma, stability

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INTRODUCTION

The knee is one of the most frequently injured joints in the human body. Knee injuries account for 35.7 to 63.2 % of all articular injuries [1]. The knee joint is formed by articulations between the distal femur, proximal tibia and the patella that are connected by a complex system of ligaments. The anatomy of the knee joint makes it vulnerable to injury, the ligamentous apparatus with extra-articular and intra-articular ligaments, in particular. The collateral extra-articular ligaments are important stabilizers of the knee joint and are represented by the tibial collateral ligament (lig. collaterale tibiale) that runs perpendicular to the frontal axis on the medial side and the fibular collateral ligament (lig. collaterale fibulare) located on the lateral side of the knee [2–8]. The tibial collateral ligament (TCL) is one of major ligaments of the knee joint that resists valgus angulation. Incidence of TCL injury is reported to be 3 per 1,000 people. The injury occurs in an indirect mechanism of excessive outward rotation of the tibial bone and results in medial instability with excessive tibia deviation outward as compared to the healthy limb [9].

Medial instability of the knee as one of the most frequent complications of TCL injuries leads to the development and progression of deforming arthritis and impaired function of the lower limb that significantly limits the person's ability to work. Stabilization of the knee is essential in the treatment of TCL to prevent the development of adverse events [10–16]. Tibial collateral ligament injury can be treated conservatively with prolonged immobilization and limited weight-bearing on the injured limb. Clinical experience and a high complication rate after conservative treatment indicate the need for surgical intervention to restore the integrity of the TCL [17, 18].

The purpose was to demonstrate a successful management of a patient with ruptured TCL of the right knee joint and substantiate the priority of surgical treatment in the case.

MATERIAL AND METHODS

We report a case from our clinical practice. A 46-year-old patient N. was admitted to the trauma department on 24.01.2020 immediately after receiving a domestic injury with sharp knee pain, impaired function and malaligned lower limb. Physical examination demonstrated the lower limb straightened and rotated outwards. The right knee joint appeared to be swollen and malaligned. Femoral condyles were collapsed on the

anterior aspect of the knee and were visualized on the posterior aspect of the knee joint. The antero-posterior size of the knee joint was increased. The vertical axis of the femur was displaced posteriorly and medially and the tibial axis was deviated anteriorly and laterally by 5–7° relative to the whole axis of the limb. No active movements were seen in the knee joint. The skin of the tiabia was pale, the pulsation reduced. Sensitivity in the right lower limb was intact. Radiographs showed dislocation of the right tibia (Fig. 1). The patient was diagnosed with closed traumatic dislocation of the right tibia, a rupture of the medial collateral ligament of the right knee joint. The patient was referred to a trauma hospital where dislocation was reduced with skeletal traction using the right calcaneus. She had chronic non-obstructive bronchitis (in remission) and impaired glucose tolerance identified among comorbidities.

Patient N. underwent surgical treatment with open lavsanoplasty of the tibial collateral ligament of the knee joint according to Yamshchikov (patent RU No. 2743841) following laboratory and instrumental examinations and preoperative preparation [19]. The operation was performed under spinal anesthesia with obtuse and acute access performed with a parapatellar incision on the medial aspect of the knee. The TCL was found to be disfibered and unsuitable for stitching. A plastic surgery was an option. Channels were formed in the medial condyles of the tibia and femur to place 2 cancellous screws with tooth-like washers in medial-to-lateral plane, parallel to the articular space of the knee. The exact location of the holes for the screws was identified according to the principle of minimal changes in the distance between the femoral and tibial attachments of the TCL at all tibia flexion angle to prevent overextension of the graft and restore adequate kinematics of the joint. The screws were not deep in the bone leaving a protruding portion of 2–3 cm out. A lavsan tape was X-shaped drawn through the screws and the ends were tightened in a final knot at one of the washers, and the screws were tightened with the washer contacting the bone pressing the knot to the cortical bone. The wound was sutured by layers after the stability and the strength of the lavsan graft including maximum extension were ensured. The function of the joint was checked with the knee stability completely regained. The limb was immobilized with a plaster cast. Radiographs made a day after the operation showed congruent articular surfaces and satisfactory position of the metal construct (Fig. 2).

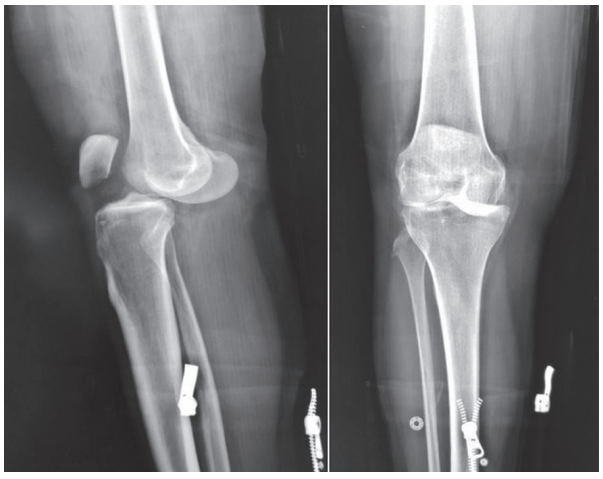

Fig. 1 Lateral and AP views of the right knee joint showing dislocated tibia

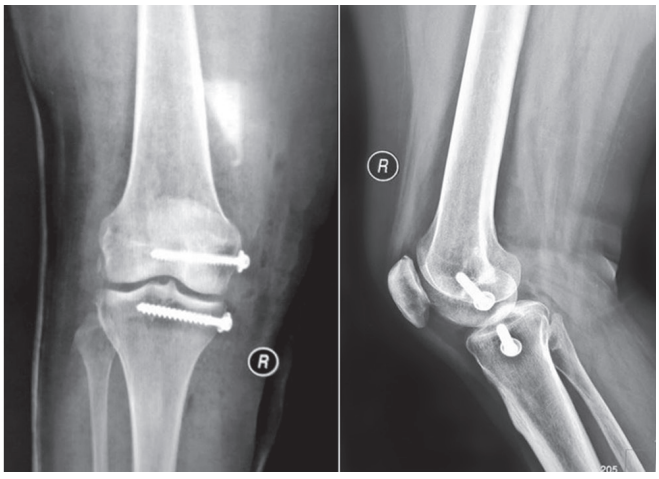

Fig. 2 Lateral and AP views of the right knee joint showing lavsanoplasty of the TCL a day after the operation

RESULTS

Postoperative period was uneventful. The patient received antibacterial therapy to prevent infectious complications, anticoagulants and nonsteroidal anti-inflammatory drugs to relieve pain and was encouraged to perform physical therapy of intact joints, isometric contraction and relaxation of the muscles of the intact limb, respiratory exercises.

The patient was allowed to use crutches for the gait after 3 postoperative days without no weight-bearing on the operated limb. The patient was discharged from the hospital in a satisfactory condition after 8 postoperative days to receive outpatient treatment at the place of residence. She was recommended gradual weight-bearing on the operated limb, the timing of radiographs and the duration of immobilization with a plaster splint. The wound healed by primary intention. The stitches were removed after 14 postoperative days. The rehabilitation period was uneventful and the patient could walk with crutches gradually increasing weight-bearing on the operated limb. The patient could ambulate unassisted and presented no complaints at 12 months. Physical examination revealed a postoperative scar on

the medial surface of the knee joint with movements in the right knee fully regained, and no functional abnormalities in the limb identified (Fig. 3). The axis of the right lower limb was anatomically realigned and joint stability fully restored (Fig. 4) The radiographs demonstrated congruent articular surfaces of the knee. The patient was admitted to a trauma hospital for removal of metal constructs. The patient maintained stability of the knee joint with the articular surfaces on the X-ray being radiologically congruent after removal of the metal constructs (Fig. 5).

Fig. 3 Flexion regained in the involved joint

Fig. 4 Stability of the knee joint restored after lavsanplasty of the TCL

The patient with a rupture of the TCL was treated with a lavsan graft fixed to two cancellous screws with tooth-like washers placed in the medial condyles of the tibia and femur. Open lavsanoplasty of the TCL of the knee resuled in completely regained limb function and anatomical integrity of the TCL. The functional result of the limb was assessed by an amplitude of movement in the knee to be completely restored, absence of pain at the gait. The patient could maintain the good result after removal of the metal construct.

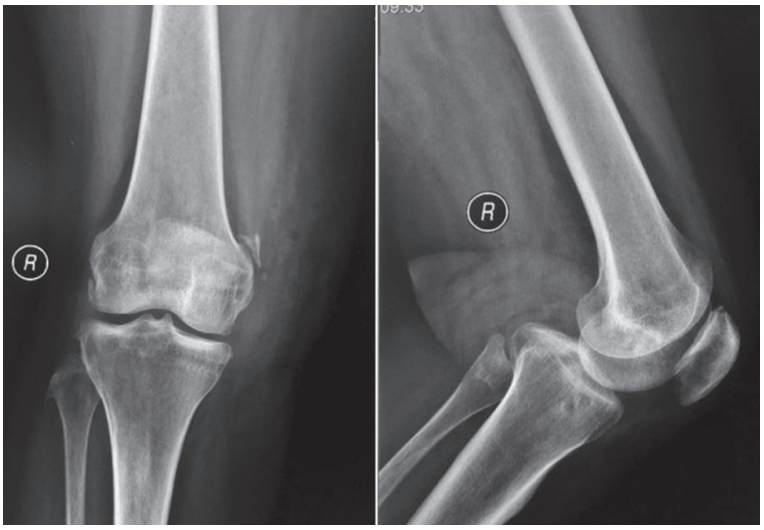

Fig. 5 Lateral and AP views of the right knee joint showing the metal construct removed

DISCUSSION

Incidence of TCL injury is reported to be 3 per 1,000 people. The injury results in medial instability with excessive tibia deviation outward as compared to the healthy limb [9]. Stabilization of the knee is essential in the treatment of TCL to prevent the development of the common adverse event of deforming arthritis of the knee [10–16]. Conservative treatment of TCL has been shown to be effective for many years. Clinical experience indicates the need for surgical intervention to promote early verticalization and ambulation of

the patients. It is also associated with reduced risk of joint contracture, muscle hypo- and atrophy, hypostatic complications with prolonged bed rest and medial instability of the knee joint with resultant deforming arthrosis and insufficient stabilization of the joint due to conservative method [17, 18]. A variety of reconstructive procedures based on the use of different grafts (autografts of the adjacent tendons of the femur muscles, the patellar tendon, the fascia lata, allografts from synthetic materials including lavsanoplasty) have been developed in search for optimal surgical treatment of damaged TCL [5]. However, the use of autograft is associated with a high complication rate including additional trauma of the tendons of the femur muscles with persistent pain, impaired proprioceptive function of autografted tendons, development of reflex sympathetic dystrophy and muscle hypotrophy, low strength of the graft with a risk of rupture when the patient ambulates [5]. The use of synthetic allografts according to well-known techniques [3] can also lead to poor results due to graft fibers dissociated with the cutting edges of the metal fixator at the gait.

The case reported have demonstrated successful treatment of TCL rupture with no complications due to advantages with the method including use of a synthetic graft of a high strength, the lavsan band rigidly fixed to the screws with tooth-like washers to prevent dissociation of the graft at the gait. The use of graft fixation according to the technique described allowed us to shorten the time of the forced position of the limb and reduce the risk of contractures, start early ambulation preserving the function of the limb. Therefore, the method of open plastic surgery of injured TCL with use of a lavsan transplant was shown to be effective and can be successfully employed in clinical practice.

CONCLUSION

Open lavsanoplasty of the TCL used as the patented technique facilitated complete recovery the injured limb, the functionality, less risk of complications providing a good clinical result.

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