

Repair of extensive bone defects of the knee joint with the Ilizarov frame (case report)

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An extensive defect of the knee bones that make up the joint (DKBJ) is one of indications to amputation and exo-prosthesis. Reconstructive procedure with the Ilizarov method is an alternative. We present a case of a female patient with DKBJ of 16 cm, shortening of the right lower extremity of 12 cm, 6 cm hypotrophic distraction regenerate bone of the right lower leg and chronic osteomyelitis of the right femur. The total length of treatment was 67 months (5½ years). The length of osteosynthesis including distraction and fixation stages was 43 months (3½ years). Complications developed during the treatment did not interfere with a good anatomical and functional outcome achieved.

Keywords: arthrodesis, bone loss, knee joint, Ilizarov technique, chronic osteomyelitis

INTRODUCTION

Defects of the knee bones making up the joint (DKBJ) are normally associated with enduringly disturbed function of the lower limb and disability [1–4]. Radical surgical debridement of osteomyelitic nidus performed during revision arthroplasty and oncologic knee reconstruction often results in extensive bone loss [1, 4–8].

Arthrodesis of the knee joint is an alternative to amputation and exo-prosthesis if another revision total knee replacement surgery cannot be performed [3, 9–11]. However, an extensive defect of the knee bones that make up the joint prevents acute reduction of the bone fragments due to draped soft tissues and vascular and neurological disorders. Reconstructive procedure with the Ilizarov external fixation can be indicated to this cohort of patients [1–4, 8, 12].

Clinical observation

Female patient P., born 1962, was diagnosed with giant cell tumour of the right-sided distal femur in 1985. The tumour was resected and customised implant placed using the Vorontsov procedure. Revision total knee replacement procedures were performed on the right side on 25.05.1993 and 20.05.2002. In 2003 the patient developed deep infection at the site of surgical intervention. The implant was removed and radical surgical debridement of osteomyelitic nidus produced on 05.06.03. The surgery resulted in a 30 cm bone defect. In 2004 the defect was treated with vascularized fibular graft, tibial corticotomy and an attempt was made to repair the defect with the Ilizarov external fixation that re-

sulted in consolidation at the graft and tibia contacting area and hypoplastic regenerate bone in the middle third of tibia. In 2006 the patient was admitted to R.R.Vreden Russian Research Institute of Traumatology and Orthopaedics and diagnosed with a 16 cm defect of the knee bones that make up the right-sided joint, 12 cm shortening of the right lower limb, 6 cm hypotrophic distractional regenerate bone of the right tibia, chronic osteomyelitis of the right femur, tibia at the remission phase (**Fig. 1**). The patient refused multiple amputations she was offered.

The first stage of treatment included combined (hybrid) application of external fixation device (EXD) on 25.01.06, corticotomy and osteoclasis of tibia produced in the middle third followed by distraction to fill in the defect and compression at the hypotrophic regenerate bone and defect levels (**Fig. 2**). Corticotomy and osteoclasis of femur followed by distraction to repair the defect of the knee bones making up the joint were produced on 09.03.06. The 120-day distraction resulted in distractional regenerate bone measuring 8 cm in the femur and 13 cm in the tibia (**Fig. 3**).

Open debridement at the docking femoral and tibial site was produced at the second stage on 26.03.07. Achilles tendon was lengthened and hinged transosseous module placed to correct equinus of the right foot (**Fig. 4**). The total period of osteosynthesis lasted for 30 months including 12-month distraction and 18-month fixation (**Fig. 5**). EFD was removed on 10.09.08. The remaining

shortening of the lower limb was 8 cm at that time.

The third stage of treatment included EFD mounted on 05.10.10, corticotomy and osteoclasis of the right femur. Distraction lasted for 110 days and resulted in 8 cm regenerate bone. Mechanical realignment the lower limb was performed with Ortho-SUV device at the end of distraction [13]. The total period of osteosynthesis lasted for 13 months including 3½-month distraction and 9½-month fixation (**Fig. 6**).

Therefore, the total treatment length was 67 months (5½ years) including cumulative period of osteosynthesis (distraction + fixation) of 43 months (3½ years).

There were several episodes of pin tract infection developed at the sites of transosseous components due to long-standing osteosynthesis with

EFD. Category I complications according to Caton classification were treated with local application of antibiotics and changing dressings [11, 12]. Two EFD were reassembled due to unstable transosseous components (Category II complications according to Caton classification) and they had no impact on the final result of treatment.

Long-term follow-up was evaluated in November 2016, 5 years after the third stage of treatment (**Fig. 7**). The patient could walk without additional supporting means using a cane for long distances. The right lower limb was completely supporting with no signs of disturbed circulation and innervation. Lower limb length was equalised, mechanical axis of the right lower limb well realigned. The patient could use a manually operated car, was married and raised a child.



Fig. 1 Anteroposterior and lateral radiological views of the right lower limb in a female patient with defect of knee bones making up the joint



Fig. 2 Photograph (a) and radiographs of the right lower limb (b) in the patient showing combined (hybrid) application of external fixation device (EFD), corticotomy and osteoclasis of tibia in the middle third followed by distraction for defect repair and compression at hypotrophic regenerate bone and defect levels



Fig. 3 Photograph (a) and radiographs of the right lower limb (b) in the patient after corticotomy and osteoclasis of the femur followed by distraction to fill in defect of the knee bones making up the joint.

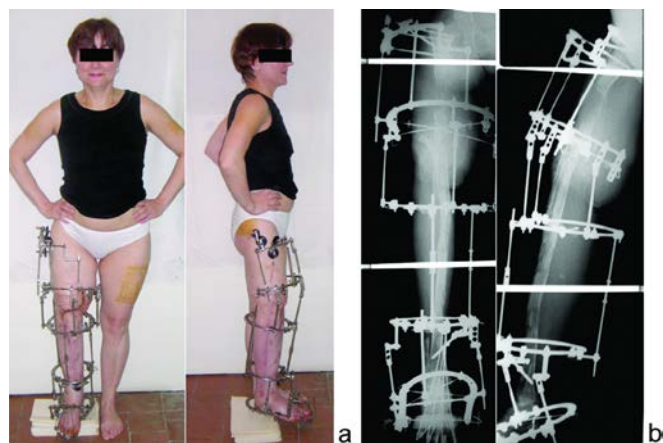


Fig. 4 Photograph (a) and radiographs of the right lower limb (b) in the patient after Achilles tendon lengthening and placement of hinged transosseous module to correct equinus of the foot



Fig. 5 Photograph and radiographs of the right lower limb in the patient during external fixation (a) and after removal of EFD (b)



Fig. 6 Photograph and radiographs of the right lower limb in the patient showing compensation of the remaining shortening and correction of the mechanical axis of the lower limb (a), fixation phase (b) and after EFD removal (c).



Fig. 7 Photographs and radiographs of the right lower limb in the patient at 5-year follow-up

DISCUSSION

Periprosthetic infection following total knee arthroplasty is reported to occur from 0.57 to 15 % of the cases [14]. Revision procedures, the use of constrained implants increase the risk of infection [15]. The complications following total knee replacement are the most common cause of the knee arthrodesis with chronic osteomyelitic nidus being a contraindication to revision joint replacement [11]. According to different authors shortening of an operated limb following knee arthrodesis can measure from 1.5 cm to 6.4 cm [11, 16]. Staged reconstructive procedures can be advocated for extensive defects of the knee bones making up the joint following removal of on-

cology implants [1, 3, 11, 15]. There is good evidence that arthrodesis of the knee joint can be the more suitable option as compared to amputation [11]. Amputation after total knee arthroplasty considerably impairs quality of life because of poor ambulation capabilities [17]. However, singular cases of successful treatment of DKBJ are reported with the usage of oncology implants. Hatzokos I. et al. (2010) described two cases treated for DKBJ of 25 cm and 19 cm. Osteosynthesis lasted for 27 and 34.7 months, correspondingly. SF-36 scores showed considerable improvement in both physical and mental aspects of life [15].

CONCLUSION

Treatment of the patient with extensive defect of the knee bones that make up the joint was multi-staged, time-consuming and demanding. However, it appeared an alternative to amputation and exo-prosthesis the patient refused. She was com-

pletely satisfied with the outcome and approved the adequate surgical tactics selected.

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