Limb Salvage Using The Ilizarov Technique After Infected TKA

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَأَنْزَلَ اللَّهُ عَلَيْكَ الْكِتَابَ وَالْحِكْمَةَ وَعَلَّمَكَ مَا لَمْ تَكُنْ تَعْلَمُ وَكَانَ فَضْلُ اللَّهِ عَلَيْكَ عَظِيمًا

صدَقَ الله العَظِيم

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Aim of the Essay

The aim of this essay is to highlight the various and most recent methods of limb reconstruction, concentrating on the Ilizarov technique, after failure of an infected total knee arthroplasty.

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Introduction

Arthrodesis as a salvage procedure remains a durable, time-proven technique for treatment of sepsis, tumor, failed arthroplasty, and the flail limb. Arthrodesis of the knee can be performed through various techniques: (a) compression arthrodesis with external fixation, (b) compression arthrodesis with compression plating, (c) intramedullary rod fixation, and (d) a combination of intramedullary rod fixation and compression plating. [(1)]

Arthrodesis as a salvage procedure for a failed septic knee replacement is indicated in the following circumstances: (a) persistent infection recalcitrant to repeated debridements and antibiotic regimen; (b) disruption of the extensor mechanism; (c) an infectious organism that is only sensitive to severely toxic antibiotic agents, such as *Candida albicans* or other fungi; and (d) a young patient or a disillusioned older one who does not wish to face possible future revision arthroplasties. Occasionally, fusion may be the best choice for a very heavy patient with a septic TKA failure. Although certain patients insist on TKA reimplantation after septic TKA, some do not want to risk recurrent infection, and choose arthrodesis as their definitive treatment. [(1)]

Factors have to be considered when choosing between revision arthroplasty or arthrodesis: the patient's age, medical status, activity level, the basic disease process and the condition of other joints, particularly the hips and contralateral knee. We are not particularly concerned about revision arthroplasty that will still allow preservation of sufficient bone stock for subsequent arthrodesis. However, revision arthroplasty that would require the use of a bulky stemmed prosthesis which, if failed, would not allow a salvage procedure short of probable amputation, must be considered. [(2)]

Knee arthrodesis should be reserved for the carefully selected patient as a salvage procedure for treating infection, bone loss, and instability. Techniques that provide more rigid fixation should be selected to promote bony union. Currently, the major indication for knee fusion is the failed septic total knee arthroplasty, which remains the most difficult circumstance in which to obtain arthrodesis. [(3)]

External compression arthrodesis is the technique of choice in the majority of cases. In the presence of infection, this method clearly is preferred over internal fixation. [2]

External fixation for knee arthrodesis has some advantages over internal fixation and intramedullary nailing. It can be used in actively septic knees, it allows control of compression and alignment after surgery, and it has the theoretic advantage of not leaving any retained hardware after fusion. [4]

Internal fixation and intramedullary nailing provided excellent fusion rates in native joints. However, fusion rates plummeted in the setting of failed TKA because of the additional problems of limb shortening, significant bone loss, and a resultant fusion interface with less bony opposition. Soft tissue is often compromised because of the presence of infection or earlier procedures. Fusion failure has been more prevalent with the more constrained implants as more bone is typically lost. [5]

Deep infection is a very serious complication of TKA which usually requires removal of the implant and attempted arthrodesis. Orthopaedic surgeons will be confronted increasingly with this problem as the number of TKAs performed increases, especially in younger patients. Intramedullary nailing has been the most reliable method of achieving arthrodesis. This technique has two significant disadvantages. [6]

First, arthrodesis can be affected only after the infection has been successfully treated. The interval between the removal of the prosthesis and the eradication of the infection may be up to 40 weeks. Secondly, autologous bone grafting should be performed at the same time. An Ilizarov arthrodesis has the advantage that it can be performed in the presence of active infection. The infection subsides with continuous axial compression and treatment with antibiotics, and the arthrodesis proceeds to union. [6]

CHAPTER 1

ANATOMY OF THE KNEE JOINT

Anatomy Of The Knee Joint

The knee joint is a modified hinge type of synovial joint &it is the largest and most complicated articulation in the body. It allows complete flexion and extension, some rotation and adduction-abduction movements. It is a compound joint that includes two condylar joints between the femur and the tibia and a saddle joint between the patella and the femur (fig.1). [7]

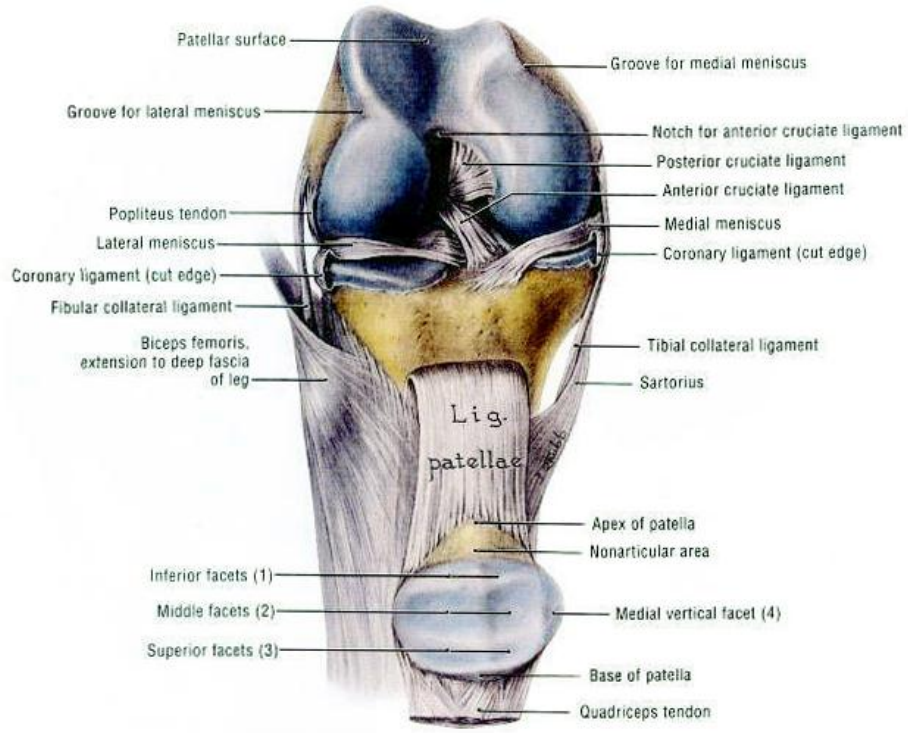

Fig. (1): Diagram showing the interior of the knee. [8]

Anatomical structures at the area of the knee include the following:

- Skin and deep fascia.
- Osseous structures.
- Extra articular structures:

Muscles and tendons.

Capsule ad ligaments.

Bursae and synovium

- Intra articular structures:

The cruciate ligaments.

The menisci.

- Blood supply of the knee joint
- Nerve supply of the knee joint.[7]

Skin & deep fascia

The skin over the anterior region of the knee is moderately thin & has high degree of mobility. The subcutaneous structures lying in the front of the knee include the pre patellar bursa, vessels, nerves & lymphatics. [7]

Osseous structures

The osseous structures that share in the knee joint are the femur, the tibia & the patella. The distal femoral condyles have been described as cams, composed of three distinct circular segments: anterior, central, and posterior. The medial femoral condyle is larger than the lateral condyle in anteroposterior and proximodistal dimensions. This difference contributes to medial compartment contact area being on average 1.5 times greater than lateral compartment contact area. In the Sagittal plane, the radius of curvature of the posterior segment of the medial femoral condyle is on average 2 to 3 mm larger than the lateral condyle. However, the radius of curvature of the distal (central) segment of the lateral femoral condyle is slightly larger than that of the corresponding segment of the medial femoral condyle (fig.2). [9]

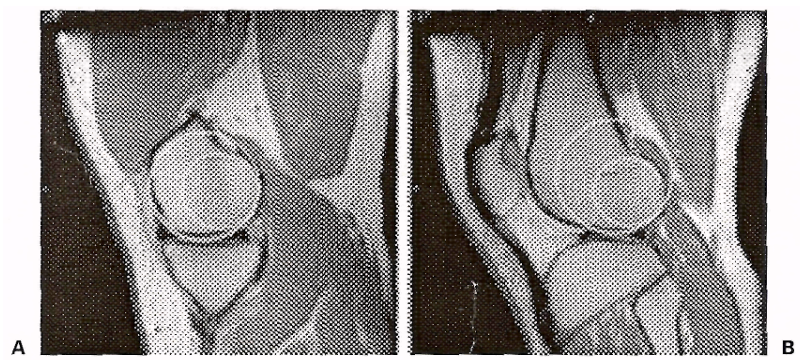

Fig. (2): Distal femoral condyle contours. (A) Medial femoral condyle. (B) Lateral femoral condyle**.** [9]

This asymmetry contributes to the screw-home phenomenon of passive knee motion. From 0 to 20 degrees of flexion the lateral condyle rolls posteriorly more than the medial condyle, producing external femoral rotation and lateral rollback. The asymmetry between the two femoral condyles also contributes to ligament tensioning and the slight valgus alignment of most knees. [9]

Nearer to the posterior than to the anterior part of each femoral condyle is the irregular prominence of the epicondyle for the attachment of the collateral ligaments. Proximal to the medial epicondyle is the small bone projection for the insertion of the adductor Magnus muscle, the adductor tubercle. Below the lateral epicondyle is a depression marking the origin of the popliteus muscle and lodging its tendon. The condyles are separated posteriorly by a deep fascia. The intercondylar notch, within which the cruciate ligaments are lodged and to the walls of which their upper extremities are attached. [7]

Viewed from above the articular surface of both tibial plateaus are ovoid. In the coronal plane the medial and lateral tibial condyles are nearly flat (slightly concave), curving upward toward the tibial spines. In the sagittal plane the lateral condyle is convex with a distinct posterior slope. The lateral condyle is flat in its central portion. Anteriorly the lateral condyle angles distally, permitting accommodation of the anterior horn of the lateral meniscus as it moves during knee extension. Posteriorly the lateral condyle also angles distally, receiving the posterior horn of the lateral meniscus when flexion surpasses 90 degrees. [9]

Different from the lateral side, the medial tibial condyle is concave in the sagittal plane. The central portion of this condyle is more complex, angling proximally in its anterior aspect and flat in its posterior aspect. Like the lateral condyle the posterior region of the medial tibial condyle never directly articulates with the femur. Anteriorly the tibial condyle angles distally to accommodate the anterior horn of the medial meniscus. [9]

The median portion of the tibia between the plateau is occupied by two elevations, the medial and lateral tubercles. Anteriorly, there is a depression,