Management of Intercalary Tibial Bone Defect by Ilizarov Technique

Essay Submitted for Partial Fulfillment of the Requirement
for Master Degree
In
Orthopaedic Surgery

By
Ayman Mohammed GabAllah
M.B., B.Ch. Ain Shams University

Supervised by

Prof.Dr. Mahmoud Mohammed Fayed
Professor of Orthopaedic Surgery
Faculty of Medicine
Ain Shams University

Dr. Mohammed Abd El Moniem El Gebeily
Lecturer of Orthopaedic Surgery
Faculty of Medicine
Ain Shams University

Faculty of Medicine
Ain shams University
2016

Abstract

Because of difficulty in managing tibial segmental bone defects and the resultant poor outcomes, amputation historically was the preferred treatment. Massive cancellous bone autograft has been the principal alternative to amputation. Primary shortening or use of the adjacent fibula as a graft also has been used to attempt limb salvage. Of more recent methods of management, bone transport with distraction osteogenesis has been suggested as the leading option for defects up to 30 cm, but problems include delayed union at the docking site and prolonged treatment time. Free vascularized bone transfer has been suggested as the leading option for defects of up to 26cm, but hypertrophy of the graft is unreliable and late fracture, common. Bone graft substitutes continue to be developed, but they have not yet reached clinical efficacy for tibial segmental bone defects. Although each of the new techniques has shown some limited success, complications remain common.

Key words:

tibia; bone defect; safe zones; half pins; olive wire; ilizarov; high energy trauma; osteomyelitis; bone tumors; smoking; alcohol; NSAIDs; corticosteroids; malnutrient; peripheral vascular disease; acute shortening; bone segment transfer; distraction osteogenesis; grafts; fibular graft; reconstruction ladder; soft tissue defect; skin graft; flap; contractures

Contents

ACKNOWLEDGEMENT

First of all thanks to **Allah**, who gave me the power and strength to complete this work. I would like to express my special appreciation and thanks to my supervisors **Prof.Dr. Mahmoud Mohammed Fayed** Professor of Orthopaedic Surgery and **Dr. Mohammed Abd El Moniem El Gebeily** Lecturer of Orthopaedic Surgery, they have been tremendous mentors for me. I would like to thank them for encouraging my research and for allowing me to grow as a research scientist. Their advice on both research as well as on my career have been priceless.

A special thanks to my family for their great support.

List of tables

List of figures

Introduction

Intercalary tibial bone defect can result from trauma, infection, or malignancy. In past amputation was the treatment for most of these cases. Recently management techniques of limb reconstruction (salvage) surgeries have replaced amputation in most of cases, but with great demand of technical experience. (1)

Limb reconstruction surgeries are almost always multistage procedures that depend on many factors. These factors include patient`s factors, description of bone defect, associated soft tissue injury and cause of defect. Patient`s factors are so important that it is one of the cornerstones of reconstruction success. This includes good assessment of patient generally and preoperative discussion of goal, period and expected complications of surgery. The assessment should check general health condition, local defect condition and patient`s needs. (2)

Some surgeons have classified management protocols based on the length of the segmental bone defects. Other surgeons consider factors other than length of the defect to be so important that they do not base the treatment primarily on

the size of the segmental defect such status of the tibia and ipsilateral fibula as a guide during the selection of the appropriate reconstruction procedure especially in cases of osteomyelitis induced bone defects. (3)

Different surgical techniques for reconstruction of tibial bone defects are available. Autogenous bone graft, Induced membrane technique, distraction osteogenesis and the use of vascularized fibular. (1)

The advantages of using ilizarov technique for reconstruction of tibial intercalary bone defects include reliability, minimal risk of further injury to soft tissues, ability to bear weight during the reconstruction and, most importantly, the wide range of bone defect sizes that can be reconstructed. Other advantage is the ability to correct other associated angular deformity in acute or gradual fashions. (4)

Bone defects are often associated with soft-tissue defects that require surgical management. The treatment strategy for soft-tissue coverage should be determined in conjunction with the plan for bony reconstruction following patient stabilization and thorough debridement of traumatic wounds. In ilizarov technique wide range of soft tissue reconstruction

procedures are facilitated due to the rigid fixation of the apparatus and easily access to wounds that needs continuous debridement and dressing.(6)

Although the great advantages of ilizarov technique, it has complications that is related to the technique itself or the patient. Most of this complication is minor and treated efficiently by good preoperative assessment, good anticipation of possible undesired effects and most important prompt treatment of any complication. (73)

Aim of the Essay

The aim of this study is to highlight the causes, classification, assessment and management of intercalary tibial bone defect by ilizarov technique.

Chapter 1: Anatomical tibial safe zones

Safe zones, as indicated as in an anatomical cross section, become meaningful only if the surgeon can locate that appropriate level on the limb. One can divide a limb segment into any number of levels and provide corresponding cross sections but this leads to information overload. Fortunately, neurovascular structures follow known paths around the major long bones and changes in position occur at fairly consistent levels. Such changes can be utilized to simplify knowledge of cross-section anatomy for the purpose of half pin or wire insertion. We shall also introduce a method of using surface anatomy together with corresponding cross sections to enable a system of safe zones that is repeatable across limbs of any size or individuals of any age. (8)

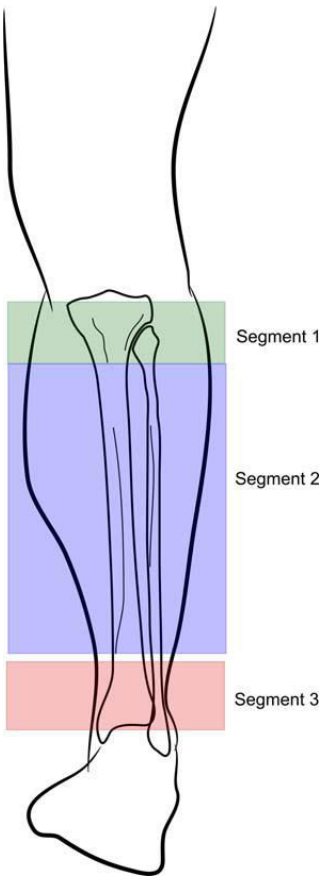

Fig. 1 The three segments of tibia

Ilizarov external fixator use has its highest frequency in the lower limb.

In the lower limb, Structures at risk are the:

1) The common peroneal nerve around the neck of the Fibula

2) The deep peroneal nerve within the anterior compartment of the leg, in close proximity to the anterior tibial vessels

3) The posterior tibial neurovascular bundle which courses close to the posteromedial border of the tibia in the distal third. Useful surface markings are knee joint line, neck of fibula, distal metaphyseal flare and ankle joint line. The tibia can be divided into three segments *(Fig. 1):*

1. Knee joint line to the neck of fibula
2. The neck of fibula to the distal metaphyseal flare
3. The distal metaphyseal flare to the ankle joint line. The safe zones within these segments are such that fairly consistent patterns of wire and half pin placement can be used. (8)

Segment 1

This spans the knee joint to the neck of the fibula *(Fig 2)*. Two important anatomical points need to be noted:

1. The synovium and capsule of the knee joint extends distal to the actual joint line. The limit of this extension is

variable and may reach as far as 15 mm below the joint line. Wires inserted proximal to this synovial 'curtain' would technically be intra-articular. Often this is not recognized until after surgery when the wire site leaks continually of synovial fluid. These wires are best replaced as there is a risk of local pin site infection becoming a septic arthritis.

2. The neck of the fibula is the surface landmark for the common peroneal nerve.

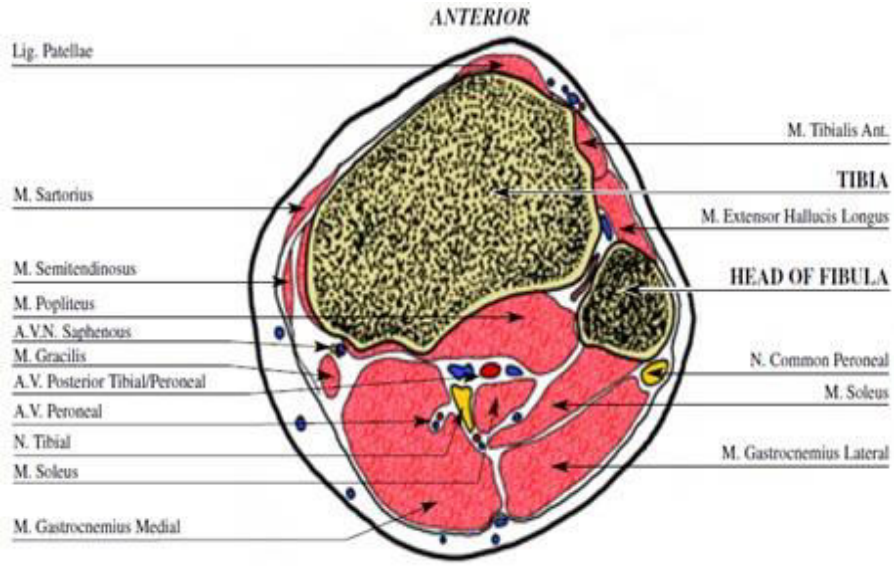

Fig 2. Segment 1 knee joint line to neck of fibula

Transfibular wires at this level must be inserted through the head of the fibula and away from the neck. Half pins have a wide corridor in this segment. They can be inserted across the palpable anterior surface of the tibial plateau, avoiding