9 Preoperative Planning in Proximal Tibia Fractures

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9.1 Conservative Versus Surgical Treatment

Through the development of modern osteosynthesis materials and implants, advancement in diagnostic procedures, and careful individualisation of treatment algorithms, the therapy of proximal tibial fractures has majorly moved from conservative to surgical treatment [1–3]. The elimination of prolonged immobilisation results in a higher range of motion and superior functional outcome. Postoperative exercise stability enables the prompt remobilisation of patients, resulting in the reduction of secondary complications such as arthrofibrosis or venous thromboembolism [4–6]. As it is, surgical treatment is the established gold standard for most proximal tibia fractures [7]. In treating proximal tibia fractures, individual fracture morphology, combined or concomitant injuries, comorbidities, and functional demands of the patient should be considered. Primary conservative treatment may be advised in minimally dislocated closed split fractures or minimally impacted stable impression fractures [8]. It is recommended to perform magnetic resonance imaging of the injured knee prior to the initiation of conservative therapy to rule out intraarticular or ligamentary knee injury. Careful consideration should be given to the possibility of ligament or meniscal lesions, even in low-energy trauma. For optimal results, high patient compliance is mandatory as treatment demands strict use of casts or orthoses in combination with partial load bearing and limitation of the range of motion over extended periods of time. Nonetheless, the risk of secondary complications and poor functional outcome is high. Regular conventional radiography should be performed to monitor fracture consolidation and detect secondary dislocation. Close patient monitoring, especially after initial trauma and after surgical intervention, is vital to detect and avoid complications such as compartment syndrome which may occur even without initial extensive soft tissue affliction [9].

9.2 Timing of Surgical Treatment

The optimal time for surgical treatment depends on the extent of the local trauma as well as additional injuries in polytraumatised patients. Especially in extensive injury patterns, primary provisional fracture stabilisation through external fixation with secondary definitive osteosynthesis may be advised [10, 11]. The distraction of the external fixator relieves pressure on the surrounding tissue and allows for quicker soft tissue consolidation. Additionally, ligamentotaxis supports

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fragment reposition until definitive treatment is scheduled. As tissue swelling is to be expected even in low-energy trauma and minimally dislocated fractures, definitive osteosynthesis generally takes place after initial soft tissue consolidation, approximately 5–8 days after trauma [12]. Premature surgical treatment may lead to unnecessary secondary complications such as soft tissue necrosis, superficial and deep infection, and compartment syndrome [13, 14]. Higher grade open fractures also require immediate surgical intervention, usually in combination with external fixation. After initial debridement and wound closure or temporary covering with artificial skin grafts or vacuum bandaging, a second-look operation should be scheduled after 2 days. Definitive treatment follows soft tissue consolidation, as previously stated. If the skin defect requires plastic reconstruction, definitive treatment should take place during the first 7 days in order to minimise the risk for secondary complications. Studies have shown good results for an alternative approach to the established multistep procedure as mentioned above. The so-called "fix and flap" approach incorporates interdisciplinary surgery and entails osteosynthesis and plastic reconstructionin a single operation, preferably under 72 h after trauma [15]. Delayed treatment may cause a significant increase in complications. Various concomitant injuries require certain deviations of standard procedure. Vascular damage demands prompt diagnostic verification and immediate surgical intervention as missed vascular injury results in high rates of amputation [16]. Nerve damage may be treated through primary or secondary reconstruction depending on the extent of the injury. If the clinical state of the patient and local conditions permit, meniscal and osteoligamentary injuries should be treated when definitive osteosynthesis is performed. Although secondary treatment after an interval of up to 6 weeks is permissible in certain situations. Cruciate ligament repair or reconstruction is also mostly carried out after initial fracture consolidation, around 6 weeks after trauma. Studies have shown that in treating elderly patients, rapid surgical intervention shows advantages in clinical recovery so that patient age and even extensive chronic comorbidities do not pose absolute contraindications per se [17]. Depending on fracture morphology, minimally invasive surgical approaches are a viable treatment alternative in such cases [18].

9.3 Pre- and Perioperative Procedure

Proximal tibia fractures present in a broad spectrum of injury patterns ranging from low-energy monotrauma with low soft tissue damage to high-energy trauma with extended local injuries and polytraumatisation. Accordingly, adequate diagnostic and therapeutic steps must be followed to ensure optimal outcome. Exact primary clinical examination is the first step that is directive for further procedure. The careful assessment and documentation of peripheral circulation, movement, and sensation is vital as those parameters are relevant predictors for the extent of the injury and, when impaired, should respectively lead to further investigation. The primary diagnostic device is conventional radiography. Additionally, each intraarticular fracture mandates complementary computed tomography. Depending on the severity of the injury, this may be performed after initial external fixation. Magnetic resonance imaging and CT- or conventional angiography may be necessary in detecting concomitant injuries, depending on the injury mechanism. After the completion of diagnostics, the exact conservative or surgical pathway should be established. Injury patterns that require immediate surgical intervention are usually primarily treated with external fixation. This is a widely available and relatively easy to apply therapeutic mean that allows for adequate soft tissue consolidation and additional plastic or trauma surgery. External fixation and compartment release must be carefully placed, as to not hinder the surgical approach of the definitive operation. Supportive therapy such as cooling braces should be applied to enable time efficient treatment. The availability of intraoperative diagnostic equipment, special

implants, and the presence of experienced surgeons are major contributors to satisfactory outcome. Lack thereof must consequently lead to quick primary treatment and patient transfer to an appropriate trauma centre for further treatment.

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