INTRAMEDULLARY LOCKING NAILS USAGE IN TREATMENT OF DIAPHYSEAL FEMUR AND TIBIA FRACTURES OF PATIENTS WITH ISOLATED MULTIPLE INJURIES

The article describes results of treatment using blocking intramedullary osteosynthesis in 76 patients with diaphyseal fractures of the femur and tibia.

Our experience application of blocking intramedullary osteosynthesis showed the following advantages causing early joints activity: no opening of fracture's line; decreased bleeding and risk of development of septic complication; blocking of above and below place of fracture excludes rotational angular mixture of bone fragments and shortening them in length. Needless of additional external immobilization in application of the method made possible the early activation of joints and shortening of hospital treatment. The received results testify the high efficiency of this method and further development the concept of early osteosynthesis in treatment of diaphyseal fractures of long bones in patients with a multiple trauma.

Keywords: Multiple fractures of femur and tibia, less invasive, locked intramedullary nailing, rehabilitation

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Introduction

Associated and multiple fractures constitute 60-70% of all injuries (Proskura, 1987). Multiple fractures in polytrauma are observed in 71.6% cases, associated fractures - in 28.4% cases (Jenny et al., 1995). 2/3 of patients are men of working age (20 to 50 years); this makes their treatment not only medical but social task (Litvina, 2010).

The blocking intramedullary osteosynthesis is the “gold standard” in the osteosynthesis of diaphyseal fractures of long tubular bones (Jenny et al., 1995). Intramedullary osteosynthesis has an absolute advantage in unilateral fractures of the tibia and femur, when from a single small incision at knee joint can be performed retrograde osteosynthesis of the femur and antegrade fixation of tibial bone with lockable nails at once (Litvina, 2010, Klein et al., 1989). The aim of this work is evaluation of surgical treatment results of femoral and tibia diaphyseal fractures by using BIOS.

Materials and methods

In our clinic 56 patients underwent the blocked intramedullary osteosynthesis during 2008-2011; 38 patients among them had multiple bone fractures of the lower extremities. 76 blocking intramedullary osteosynthesis operations of femoral and tibial bones were performed for these patients. 18 patients were with isolated femur and tibia fractures. Implantation of nails was carried out in the closed antegrade way. Reposition made by manual way or by means of nails. After correction of rotational mixture, the distal blocking with the subsequent proximal blocking was carried out. Compressions of bone fragments were carried out individually counting a character of change.

The operations were performed under the electron-optical converter control. Traumatology department physicians, to implement new high-tech methods of surgical treatment in various injuries, studied the experience of using these techniques in clinics of China, Turkey, Poland and Russia (Yaroslavl). We used hollow cannulated nails (“ChM Sp. z o.o, Poland) and solid (“Irene,” China Ltd; “DC,” Russia) nails for
intramedullary osteosynthesis of long bones. A thin flexible conductor, introduced into the medullary cavity of both fragments, was applied to install the cannulated nails.

BIOS ensures a stable fixation of diaphyseal fragments of long bones. We used femoral and tibial interlocking nails. Depending on fracture type of the femoral bone “ChM”, “Irene”, “DC” systems offer following methods of intramedullary nailing: reconstructive; compressive, dynamic and static; and retrograde. These systems for each method of osteosynthesis provide:

a. appropriate form of a nail (intramedullary rods, bolts, locking screws)
b. tools for installing and extracting of nails
c. application guide

Since 2007 we have performed 94 locking intramedullary osteosynthesis operations of femoral and tibial bones in patients with multiple and combined trauma. Closed locked intramedullary osteosynthesis was applied to 38 patients with fractures of femur and lower leg (76 fractures). 37 patients were men and 19 women aged from 19 to 47 years old. The majority of trauma was the result of traffic accidents. There were total 94 fractures defined by AO/ASIF classification to the following types: 7 femoral fractures, 11 tibial fractures and 38 multiple fractures, 24 femoral and tibial fractures - type C, 37 fractures - type A, 33 fractures - type B.

It is worth to note that the closed femur fractures should be operated on as early as possible in order to prevent the development of posttraumatic fat embolism and to alleviate patient’s care in an intensive care unit (Skorogljadov et al., 2004). Early performed less invasive diaphyseal osteosynthesis of femoral and tibial fractures lowers the possibility of dangerous complications such as post-traumatic fat embolism. Complex system of prevention and treatment of fat embolism has been developed and introduced into the practice for patients with severe associated injury. Conventionally, it can be divided into the following stages:

2. Admission department procedures
   a. Diagnostic procedures
   b. Medical aid is provided in the operating room by anesthesiologist and resuscitation specialist

3. Specialized medical treatment provided by a traumatologist and carried out in the resuscitation department

The tasks of anesthesiologist-resuscitator, taking into consideration fat embolism risk at this stage of treatment, include: adequate pain relief and adequate infusion-transfusion therapy provision.

To patients with severe combined trauma are mainly administered with: regional anesthesia (spinal and peridural anesthesia) with narcotic analgesics; and multicomponent intravenous anesthesia with muscle relaxants and endotracheal artificial lung ventilation.

Traumatologist has to also choose the simplest sparing method and accomplish bone fragments stabilization. In case of several segments trauma surgical operation is performed simultaneously on all damaged extremities by group of surgeons.

After stabilization of patients’ status, final reposition of bone fragments was carried out in the later period of treatment. Rapid decrease of acute period complications of wound dystrophy cases proves correctness of our approach.

Plaster immobilization was not used, active movements of joints adjacent to the damaged segments were carried on the second day after surgery. Walking with a partial load on an injured extremity was allowed on 3rd-5th days depending on general condition of patients. Patients with diaphyseal and periarticular fractures began to walk with full load on an injured extremity within 1-2 months after surgery, and full weight bearing of patients with intra-articular fractures solved individually. Dynamic X-ray and clinical monitoring was carried out in 47 patients. Consolidation of fractures and restoration of injured extremities support function achieved at 43 patients on 6-8th months after
surgery. Among these patients in 36 cases fixators were removed in 14-16 months after surgery. 24 patients with different stages of bone consolidation are under outpatient observation; three patients are currently on inpatient treatment. 2-3 months after surgery nail movement had been performed in 26 patients with comminuted and fragmentary fractures of femur and tibia by removing static screw, which prevents deformation of distal locked screws and provides a possibility to create physiological compression at the fracture site without shortening risk of damaged segment.

*Clinical case.* Matkarimov R., 38 years old, was admitted to intensive care unit after traffic accident (hit by a motor vehicle). Diagnosis: Associated trauma. Closed craniocerebral injury. Brain contusion. Closed comminuted fracture of left femur between middle and lower parts with displaced fragments. Closed middle third displaced fracture of right tibia. Closed left malleolar fracture with external ankle subluxation (Pott’s fracture).

After stabilization of patient’s status, we performed closed blocking intramedullary osteosynthesis of the left femur with a static fixation and blocking intramedullary fixation of the left tibial bone with dynamic blocking on the 3rd day of injury. Patient started active movements in adjacent joints from the 2nd day after surgery. On the 3rd day after surgery he began walking on crutches with a partial load to the damaged extremity. Postoperative wound healed by first intention, patient was discharged to outpatient treatment. Length of stay in hospital was 26 days. Dynamic, clinical and radiological observations had been carried out. Patient started walking 10 weeks later after nailing with a full load on the damaged extremity. By this time, the range of motion in knee and hip joints of damaged segment became normal. After 6 months there was a complete clinical and radiological consolidation of the fracture. Patient returned to his previous job and vital activities. Metal construction was removed on 18th month after fixation.

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**Figure 1. a, b - Preoperative Radiographs. c - Brain MSCT**

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Complications: In early postoperative period following complications were observed: deep soft tissue abscess at the fracture site in 3 patients. In all cases infectious process was reduced without removing metal construction.

Figure 2. A, B, C, D – POSTOPERATIVE PHOTO RADIOGRAPHS

Delayed consolidation of comminuted fractures of tibial bone was observed in 5 cases, which was recovered by nail movement.

Noted: migration of distal locking screws - 4, excess length of locking screws - 7, nail break during fracture healing - 1, healing failure - 1.

Healing after primary osteosynthesis occurred in 81 cases (86.1%). In these patients result of treatment according to Mattis dementia rating scale is excellent - in 83% cases, good - in 12% cases. Unsatisfactory result of the treatment is in one patient (osteomyelitis). Treatment result is unknown in three cases (3.1%). Thus, total positive results of treatment makes 95.2% of all studied cases.

Conclusion

Comprehensive preventive and treatment systems of fat embolism, which was developed in our clinic, reduced the incidence of fat embolism cases by 10%, and severe fat embolism by 5% in patients with severe associated trauma, at the same time mortality rates among this group of patients decreased by 1-2%.
Closed blocking intramedullary osteosynthesis of diaphyseal fractures of the femur and tibia, performed according to strict indications with a static blocking of main fragments, restored support ability of extremity.

The correct choice of technique and technical equipment of the operation (electro optical converter, orthopedic table, special instrumentation) as well as proper management of the patient in post-operative period avoided complications, such as poor fixation of bone fragments, locking screws break, etc.

Needless of additional external immobilization in application of the method made possible the early activation of joints and shortening of hospital treatment.

The results received by us testify the high efficiency of this method and further development the concept of early osteosynthesis in treatment of diaphyseal fractures of long bones in patients with a multiple trauma.

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