

## "DAMAGE CONTROL" STRATEGY IN THE TREATMENT OF POLYTRAUMA PATIENTS WITH OPEN FEMORAL SHAFT FRACTURE COMBINED WITH SPLENIC RUPTURE - A CASE REPORT

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Polytrauma represents the most difficult form of trauma epidemic. Appropriate treatment of the femoral shaft fracture in polytrauma patients can significantly reduce mortality and morbidity. External skeletal fixation in patients with femoral shaft fracture presents a minor surgical trauma with minimal blood loss. In modern trauma centres, external skeletal fixation in polytrauma patients is a temporary method (as a part of „damage control“ strategy) where immediate extensive internal fixation could be risky. It is usually postponed until the patient status is stable with normal vital parameters.

This paper presents a polytrauma patient with dominant abdominal injury and femoral shaft fracture. During the same operation, external skeletal fixation was applied after abdominal surgery was done. Conversion of external into internal fixation was carried out because of postoperative febrile state that lasted for 14 days. External skeletal fixation was a definitive method of treatment. Fracture of the femoral shaft healed after 7 months with good functional outcome.

External skeletal fixation is a successful method of treatment for femoral shaft fracture in polytrauma patients. It is a temporary method as a part of „damage control“ strategy and is usually followed by internal fixation. Sometimes, it is a definitive treatment method in patients with open and comminuted fractures of the femoral shaft and in polytrauma patients when the above mentioned conversion is not safe. *Acta Medica Mediana* 2011;50(3):58-62.

**Key words:** polytrauma, femoral shaft fracture, external fixation, damage control

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### Introduction

Trauma is the leading cause of death and disability in younger working-age population. The most difficult form of trauma epidemic is polytrauma. The most frequent and the most severe cases of polytrauma are caused by traffic accidents (1).

Surgical treatment of polytrauma patients in order of urgency is vital for success. Life-threatening injuries must be treated first (2). It is also necessary to properly assess the capability of injured patients to withstand additional surgical trauma. Appropriate treatment of the femoral shaft fracture can significantly reduce mortality and morbidity (3). The goals of early fixation in poly-

trauma patients are: control of bleeding, suppression of local inflammatory response and extended secretion of inflammatory mediators, relieving the pain, easier postoperative care and better mobility in intensive care unit (4).

External skeletal fixation of the femoral shaft fracture in polytrauma patients presents minimal additional surgical trauma to the patient and also causes minimal blood loss. The operation is easily performed, fast and relatively simple (5). In modern trauma centres it is used as a temporary method in the „damage control“ strategy in severely polytraumatised patients who cannot tolerate the extensiveness of intramedullary fixation. After stabilising the patient, it is possible to proceed with internal fixation.

The aim of this paper is to describe the treatment of a polytrauma patient with dominant abdominal injury and femoral shaft fracture with the application of „damage control“ strategy.

### Case report

An 18-year-old man is brought to the emergency department of Surgery Clinic (Clinical Center Niš) after a head-on automobile accident. He sustained an open left femoral shaft fracture

(level IIIA), rupture of the spleen, fracture of the left clavicle and left foot injury. After a brief resuscitation, X-ray of the left thigh with the knee joint was made as well as abdominal ultrasound and abdominocentesis. X-ray showed oblique fracture of the left femoral shaft (Figure 1).



Figure 1. X-ray of oblique fracture of the left femoral shaft in polytrauma patient



Figure 2. X-ray of the femoral shaft fracture after external fixation

After positive findings on abdominocentesis and abdominal ultrasound, splenectomy was performed. During the same operation, the primary treatment and external fixation of open femoral shaft fracture was done. The fracture was stabilized with three pins of external fixator in the

proximal femoral shaft fragment and three pins of external fixator in the distal femoral shaft fragment (Figure 2).

Clavicle fracture was stabilized with a figure-of-eight immobilization.

In the postoperative period the patient was administered amp. Longacefa a 2g/24h and amp. Orvagil a 500 mg/8h. The early postoperative course was regular and the patient was transferred for further treatment to the Clinic of Orthopaedics and Traumatology, Clinical Center Niš. The wound of the open fracture was dressed on a daily basis. On the seventh postoperative day, despite the use of antibiotics, the patient got high temperature amounting up to 39.5 degrees. The control abdominal ultrasound examination showed normal results. Because of the febrile state of the patient, the conversion of external to internal fixation of femoral shaft fracture was abandoned. Regular wound dressing also included amp. Maxicefa and Amp. Amicacina. The applied therapy lead to improvement of general condition and normalization of temperature. Physical therapy was started with auxiliary crutches and conservative weight-bearing on the operated leg. The open fracture wound healed per secundam.

For further treatment the patient was transferred to the department of Physical Therapy and Rehabilitation, Clinical Center Niš. In order to stimulate fracture wound healing to obtain the range of motion in the knee joint, as well as strengthen thigh muscles, the patient was treated with magneto- and kinesitherapy, with daily dressings. Despite regular dressing, there was an infection around the pins of external fixator, and the patient was again admitted at the Clinic of Orthopaedics and Traumatology. The treatment of the infection around the pins of external fixator included parenteral antibiotic therapy and daily wound dressing. The parenteral antibiotic therapy led to the disappearance of infection. A control check with an X-ray of the left thigh with the knee joint was made and it showed dislocation of the left shaft femoral fragments. Because of that, under X-ray control, reposition and stabilization of the fracture site was done with the same external fixator system.

For further treatment, the patient was directed to the Ribarska spa centre. During his stay in the Ribarska spa, kinesitherapy increased the range of motion in the left knee joint, with knee flexion of up to 40 degrees. Upon completion of physical therapy, the check-up revealed an infection around the most distal pin of external skeletal fixator. Due to heavy secretion, regular dressing and antibiotic therapy were started. Since the infection was persistent, the most distal pin of external fixator was removed (Figure 3). The patient was advised to wash the entire upper leg and external fixator system with soap and water every day and rinse the soft tissue at the point of pin entry in the upper leg. Progressive increase in load on the left leg was continued using auxiliary crutches and increasing daily walking distance.



Figure 3. Condition of the femur after removal of the most distal pin of external skeletal fixator



Figure 6. Functional results seven months after sustaining the injury and operative treatment



Figure 4. Control x-ray made four months after surgery, with the signs of femoral shaft fracture healing (pronounced callus on the inside and back of the femoral bone)

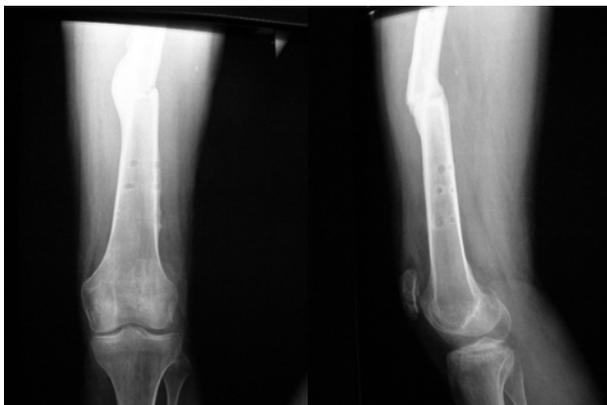


Figure 5. X-ray made seven months after sustaining the injury

The control X-ray, four months after surgery, showed the signs of femoral shaft fracture healing, with more pronounced callus on the inside and back of the femoral bone (Figure 4). The most proximal pin of the external fixator was removed due to infection. The wound at the site of the removed pin healed.

Five months after the open IIIB fracture of the left thigh followed by external fixation application, the external skeletal fixator was removed and plastic orthosis was placed on the thigh. The patient was allowed to walk with crutches with reduced reliance on the injured leg. The support and walking distance were progressively increased. The load on the foot was also increased in order to obtain flexion in the knee joint.

Seven months after surgery, a control x-ray showed a well-formed callus at the site of the femoral shaft fracture (Figure 5).

Range of motion in the left knee joint was increased. The patient can bend his left leg in the knee joint up to 90 degrees (Figure 6) and can walk with full reliance on the injured leg without aids. Currently, physical therapy is ongoing in order to get the full range of motion in the left knee joint and increase muscle strength and volume of the left thigh.

## Discussion

Clinical studies from 1970 showed that early stabilization of femoral fractures dramatically reduces the incidence of traumatic pulmonary insufficiency and postoperative complications. There is strong evidence of the good effects of early stabilization of the fracture site. Studies in the eighties showed good effects of early fracture stabilization in relation to morbidity and length of hospitalisation. This strategy in the treatment of fractures of long bones in polytrauma patients was named the "early total care" (ETC), so that the attitude "too injured to be operated" was replaced by a new one "too injured not to be operated" (8). The strategy was highly rated and supported by intensive care units. The injured

were mobilised earlier, hospitalisation period was shortened and complications due to long hospitalisation were reduced.

However, the general state in polytrauma patients with severe, multiple injuries of the chest, brain, abdomen, pelvis, etc. is not stable enough for immediate definitive surgery of the fractured bone. Studies in the early nineties described many complications associated with early stabilization of the long bone fractures. High percentages of pulmonary complications in young polytrauma patients were recorded, with lung contusions after widening and intramedullary fixation of the fracture along with increased incidence of ARDS and MOF with this approach (9, 10). The problem occurred in polytrauma patients with dominant head injury, in which early total care of fractures can lead to secondary brain damage due to hypotension and hypoxemia followed by further deterioration of the brain edema (11, 12).

A new question emerged concerning the optimal time for stabilization of long bone fractures and the choice of orthopaedic intervention to stabilize fractures.

In response to these requirements, a new strategy was developed for the treatment of fractures in polytrauma patients called "damage control orthopaedics (DCO)". Surgical technique for stabilization of fractures in this strategy is external fixation, which is a minimally invasive, expeditious method and very effective for achieving early stability with minimal additional surgical trauma (13). Final disposal of the fracture site is usually performed via intramedullary fixation when the patient's condition is stable. The optimal time "to convert" the external to internal fixation is described in the studies by Pape et al. Their conclusion is that the conversion can be done in the first two weeks after stabilization of the fracture and is accompanied by a very low rate of infection (14). Type of injuries and clinical condition of the

injured patients, in addition to the severity and type of fracture, are the main factors in determining the appropriate treatment strategies. The final osteosynthesis can be safely performed in closed and minor open fractures where all CPR requirements are fulfilled: hemodynamic stability, stable oxygen saturation, lactate levels below 2 mmol/l, no coagulation disorders, normal temperature, urine output more than 1ml/kg/h (15).

In our case, external fixation was performed immediately after resuscitation and resolution of intra-abdominal bleeding by the surgeon under the same anaesthesia, but it was decided not to convert it to internal fixation because of the febrile state of the patient that lasted fourteen days postoperatively. External fixation remained the final method of treatment.

External skeletal fixation of femoral shaft fractures in polytrauma patients allows rapid stabilization of fractures and represents minimal additional surgical trauma with minimal blood loss. The method is quick and easy. It gives a good insight into the soft tissues of the injured limb, allowing proper postoperative care of the fracture site and early mobility.

The method of external fixation is successfully used to treat femoral shaft fractures in polytrauma patients as a temporary method in the "damage control" strategy with subsequent conversion to internal fixation. Sometimes, it remains a final method of treatment in patients with severe open and comminuted fractures and in polytrauma patients when it is unsafe to perform the conversion.

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## STRATEGIJA „KONTROLE ŠTETE“ U LEČENJU POLITRAUMATIZOVANOG SA OTVORENIM PRELOMOM FEMURA I RUPTUROM SLEZINE - PRIKAZ SLUČAJA

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Politrauma predstavlja najteži oblik traumatske epidemije. Adekvatno lečenje preloma butne kosti kod politraumatizovanih može značajno smanjiti mortalitet i morbiditet. Spoljna skeletna fiksacija preloma butne kosti u sklopu politraume predstavlja minimalnu dodatnu hiruršku traumu, uz minimalni gubitak krvi. U savremenim trauma centrima koristi se kao privremena metoda u sklopu strategije "kontrola štete" kod teško politrauma-tizovanih koji ne mogu podneti ekstenzivnost unutrašnje fiksacije, uz kasniju konverziju po stabilizaciji opšteg stanja povređenih.

U radu se prikazuje politraumatizovani sa dominantnom povredom abdomena i otvorenim prelomom butne kosti koji je fiksiran spoljnom skeletnom fiksacijom u istoj anesteziji nakon zbrinjavanja intraabdominalnog krvarenja od strane hirurga. Konverzija spoljne u unutrašnju fiksaciju nije rađena zbog febrilnog stanja postoperativno, koje je trajalo 14 dana. Spoljna fiksacija bila je definitivna metoda lečenja. Prelom je zarastao za 7 meseci uz dobar funkcionalni rezultat.

Metod spoljne skeletne fiksacije uspešno se koristi u lečenju preloma butne kosti kod politraumatizovanih kao privremena metoda u sklopu strategije "kontrola štete" uz kasniju konverziju u unutrašnju fiksaciju, a ponekad i kao definitivna metoda lečenja kod teških otvorenih i kominutivnih preloma i kod politraumatizovanih kada nije bezbedno uraditi konverziju. *Acta Medica Medianae 2011;50(3):58-62.*

**Ključne reči:** politrauma, prelom butne kosti, spoljna skeletna fiksacija, kontrola štete