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FEMUR FRACTURE IN POLYTRAUMA PACIENTS AN INTERDISCIPLINARY APPROACH

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The management of polytrauma patients presents particularities in terms of evaluation and treatment, implies a standardized approach and a performing, well-prepared, multidisciplinary team. The prognostic depends on the prompt intervention at the scene of the accident, on the compliance with trauma protocols at all levels of intervention (prehospital, in the emergency room, in the operation room and in the intensive care department).
The polytrauma patient is successively evaluated by multiple teams with different specialties from the scene of the accident until the intensive care, each member having a precise role in evaluating and establishing the correct treatment of the polytrauma patient. The femoral fracture is one of the most frequent and high potential shock generators, orthopedic lesion in polytrauma patients, usually seen in cases of high energy trauma. It requires prompt diagnostic and emergency surgical treatment, due to potentially lethal complications. The correct diagnostic (both clinic and imagistic) is very important, because this type of fracture presents a high bleeding andemboligen risk. The surgical treatment consists of the external fixation of the fracture, respecting the principle of damage control, and after the potentially lethal lesions have been taken care of, the therapeutic conduit can include centromedular or paracortical fixation.The correct use of osteosynthesis techniques led to a significant decrease of both short and long term complications and also of mortality in case of polytrauma patients.

Key words: polytrauma, damage control, femoral fracture

INTRODUCTION

The trauma is the pathology of the modern era, 16.000 persons die on a daily basis from a traumatic lesion; 70-80 persons/1.000.000 persons in the general population suffer a traumatic injury. Currently there are about5, 8 million deaths / year due to trauma, the estimation for 2020 is 8,4million deaths / year. Between 1-45 years trauma is one of the main deaths causes[1].
In this situation we can say that trauma and especially polytrauma is a pathology that requires a special approach both in today's situations but also for the future, in order to develop efficient protocols, applicable to all levels of trauma care of polytraumapatients and who address all the disciplines involved in treating polytrauma .
The first mention of the term polytrauma was in 1970 and the first definition was done by Border and contributors in 1975. According to Border, *Polytrauma* represents a trauma lesions which affect at least 2 body parts with physiological impact (current or potential affectation of vital functions) and multisystem (neuroendocrine, inflammatory and immunological)[16] .
The use of Injury Severity Score (ISS) as a method of evaluating a polytrauma has become commune mostly after 1990 due to use by US military doctors in Iraq and Afghanistan[2].
A major trauma (or polytrauma) is defined as the Injury Severity Score (ISS) being greater than 15[2], but a polytrauma is not: "an association of multiple lesions with no vital potential or, only one lesion, severe, with vital potential".
The ISS is based upon the Abbreviated Injury Scale (AIS). To calculate an ISS for an injured person, the body is divided into six ISS body regions. These body regions are:

1. Head or neck - including cervical spine
2. Face - including the facial skeleton, nose, mouth, eyes and ears
3. - thoracic spine and diaphragm
4. Abdomen or pelvic contents - abdominal organs and lumbar spine
5. Extremities or pelvic girdle - pelvic skeleton
6. External and others.

To calculate the Injury severity Score(ISS), take the highest Abbreviated Injury Scale (AIS) severity code in each of the three most severely injured ISS body regions, square each AIS code and add the three squared numbers for an ISS (ISS = A2 + B2 + C2 where A, B, C are the AIS scores of the three most injured ISS body regions). The ISS scores

ranges from 1 to 75 (i.e. AIS scores of 5 for each category). If any of the three scores is a 6, the score is automatically set at 75. Since a score of 6 ("unsurvivable") indicates the futility of further medical care in preserving life, this may mean a cessation of further care in triage for a patient with a score of 6 in any category[5].

The Abbreviated Injury Scale (AIS) is an anatomically based consensus-derived global severity scoring system that classifies each injury in everybody region according to its relative severity on a six-point ordinal scale:

1. Minor
2. Moderate
3. Serious
4. Severe
5. Critical
6. Maximal (currently untreatable).

The Abbreviated Injury Score (AIS) was created by the Association for the Advancement of Automotive Medicine to classify and describe the severity of injuries[6,7,8]. It represents the threat to life associated with the injury rather than the comprehensive assessment of the severity of the injury[9]. AIS is one of the most common anatomic scales for traumatic injuries [10] . The first version of the scale was published in 1969[11] with major updates in 1976, 1980, 1985, 1990, 1998, 2005, and 2008 [12].

There are nine AIS chapters corresponding to nine body regions that are mostly overlapping the regions of the ISS:

1. Head
2. Face
3. Neck
4. Thorax
5. Abdomen
6. Spine
7. Upper Extremity
8. Lower Extremity
9. External and other.

The primary evaluation of the patients included in this study was made by an interdisciplinary team of: Emergency Medicine, Intensive Care, General Surgery, Orthopedic and Trauma Surgery, Neurosurgery, Vascular Surgery, Plastic Surgery in order to correctly evaluate all the lesions and take the best decisions regarding the patient.

The management of a polytrauma patient consists in a *Primary Evaluation* that implies; resuscitation and stabilization of vital functions (**A**irways, **B**reathing, **C**irculation, and **D**isability). Circulation, meaning, mostly fluid and blood resuscitation and hemorrhage control. Given the circumstances, a femoral fracture that could represent a 1500ml blood loss is considered, according to the German Trauma Society a resuscitating method.

A *Secondary Evaluation* detailing all traumatic injuries, and initiating treatment for the lesions (surgical and intensive care);

A *Tertiary Evaluation* (in the first 24 h) for identifying all remaining lesions

The principles for primary evaluation and stabilization of vital functions consist in:

1. Identify and treat the lesion “that kills faster”. It is important to know that an incomplete patient history should not prevent the start of the evaluation. Also, the lack of a definitive diagnosis should not prevent initiation of treatment.
2. An initial approach must be based on “physiologic” criteria (evaluating respiration, circulation, neurological status, etc.)
3. Fatal injuries must be rapidly evaluated and treated before the changes become irreversible.

The principle "Primum non nocere" should serve as main guidance in the treatment of a polytitrauma patient.

This being said it is important to) In order to avoid enhancing the initial severe imbalance induced by the trauma itself, maximum efficacy with minimum aggression will be attitude in treating a polytrauma patient. This involves choosing between two major types of surgical methods. The first one is primary intramedullary nailing; called Early Total Care (ETC) which has the advantage of just one surgical procedure, but it has an increased risk of aggravating thoracic and brain injury due to bleeding and embolic risk. The second method is Damage Control Orthopedic Surgery (DCOS) which means stabilizing the fracture in the first step by a less invasive procedure (external fixation), followed by definitive intramedullary nailing/paracortical stabilization, when the patient is stable enough so to stand to a more invasive procedure[13,14].

MATERIAL AND METHODS

This work was done by the analyzing the cases of patients hospitalized in Orthopedic section II of the Bucharest Emergency Hospital between 01.06.2013-30.06.2015. The inclusion criteria were: skeletally mature patients, with injury severity score (ISS) over 16 and diaphysis femoral fractures. At the initial selection we had 15 patients. Minimum follow-up was 12 months and we had a loss of follow-up of 6 patients, in this conditions the complete analysis was done on 9 patients. All patients included in the study signed a written consent before inclusion into the study.

For evaluating this cases we used the Injury Severity Score (ISS) that is an established medical score which assess trauma severity[3,4]. It correlates with mortality, morbidity and hospitalization time after trauma. It is used to define the term major trauma (or polytrauma).

The ETC was primarily indicated in patients with AIS 1 and 2 for thoracic, abdominal and brain injury, while DCOS was the method of choice when AIS was 4 or 5; inpatients

with AIS 3(so called "border line"), ETC and DCOS were chosen almost in the same proportion[15].
In case of DCOS, a well-staged approach with a well-coordinated interdisciplinary teem, is very important.
Stage 0 consist in initiating hemostatic resuscitation without the delay of the surgical act.
In stage 1 the patient assessment is done, especially the pathophysiological mechanism of the injury.
In stage 2 the bleeding control and contamination control is done.
Stage 3 represents an evaluation during the surgical act by a multidisciplinary team, and at this stage the decision to use an External Fixation as initial treatment for femoral fracture is taken.
Stage 4 (relalancing) is done in the intensive care service by hemodynamic optimization, correction of acidosis, hypothermia and coagulopathy, optimization and support of vital organs
Stage 5 (definitive surgery), the final decision of stabilization with intramedullary nail or paracortical stabilization (plate with screws) is taken.

RESULTS AND DISCUSSIONS

Two cases are presented for illustrating each, the attitude, of an interdisciplinary teem in treating a polytrauma patient.
First case presents a patient 33 yr. old, male, car accident, arrived at our hospital 26h after the injury with the diagnostic of "Polytrauma. Minor head trauma. Chest trauma.VII-VIII rib fractures. Abdominal trauma. Pneumoperithoneum through hollow organ damage. Left ulna fracture. Comminuted fracture of the left femur"

- Minor head trauma AIS = 2
- Rib fractures AIS = 2
- Damage hollow organ / pneumoperitoneum: AIS = 5
- Ulna fracture: AIS = 2
- Femoral shaft fracture: AIS = 3

ISS 38 = 25 + 9 = 5x5 + 3x3+2x2


A

B


C

Figure 1. Case 1: Admission imagistic evaluations; a-femur fracture X-ray, b-cubitus fracture X-ray, c- abdominal CT

After the arrival in our hospital the patient was evaluated by an interdisciplinary team and the attitude was direct admission in to the operation room where it was performed: supra and infraombilical celiotomy, lavage, enteroraphy and mesenteroraphy. The orthopedic approach was: orthopedic reduction and stabilization with an external fixation. After the surgery the patient was admitted in the Intensive Care Unit for monitoring and treatment after surgery
After amending the thoraco-abdominal pathology the patient was transferred in the orthopedic department where , first was carried out the removal of the external fixator due to pin tract infection + pin insertion for proximal tibia traction and cubitus osteosynthesis with 2 Kirschner wires.

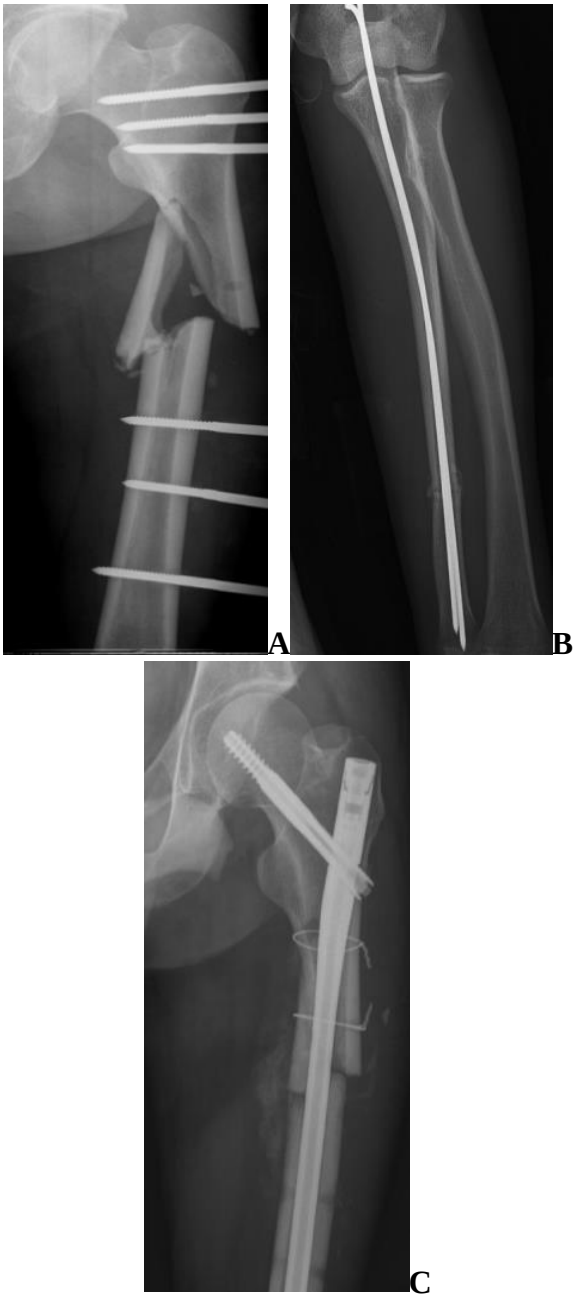

Figure 2. Case 1: Postoperatively imagistic evaluations; A-femur external fixator, B-cubitus osteosynthesis X-ray, C-femur osteosynthesis Gamma Nail X-ray

After the treatment of the pin tract holes infection the final surgical step was carried out: open reduction and internal fixation of the femur with a intramedullary long Gamma Nail and 2 circular wires.

The second case presents a patient, 48 years old, female, car accident, arrived at our hospital in 24 hours after the injury with the diagnostic of: "Polytrauma. Cranio-cerebral trauma level 1. Cervico-vertebral trauma with fracture of C5 vertebral body and lamina. Thoraco-abdominal trauma with fracture of right 4th and 5th rib with minor pneumothorax. Open fracture tip IIIB Gustilo-Anderson of distal radius epiphysis. Cominutive fracture of the right femur."

- Cranio-cerebral trauma level 1 AIS=3
- C5 vertebral body and lamina fracture AIS=4
- Rib fracture with minor pneumothorax AIS=3
- Open Distal Radius Fracture AIS =3
- Femoral shaft fracture AIS=3

ISS 34=16+9+9=4x4+3x3+3x3

Figure 3. Case 2: Admission imagistic evaluations; A,B-femur fracture X-ray, C,D-distal radius fracture.

After an interdisciplinary team evaluation and establishing that the cervical fracture does not require a surgical sanction, the attitude was admission in to the operation

room for DCOS: Closed reduction of the femur fracture and external fixation and close reduction and external fixation and surgical wound debridement of the Distal Radius Fracture. Due to general status the patient was admitted in the Intensive Care Unit.

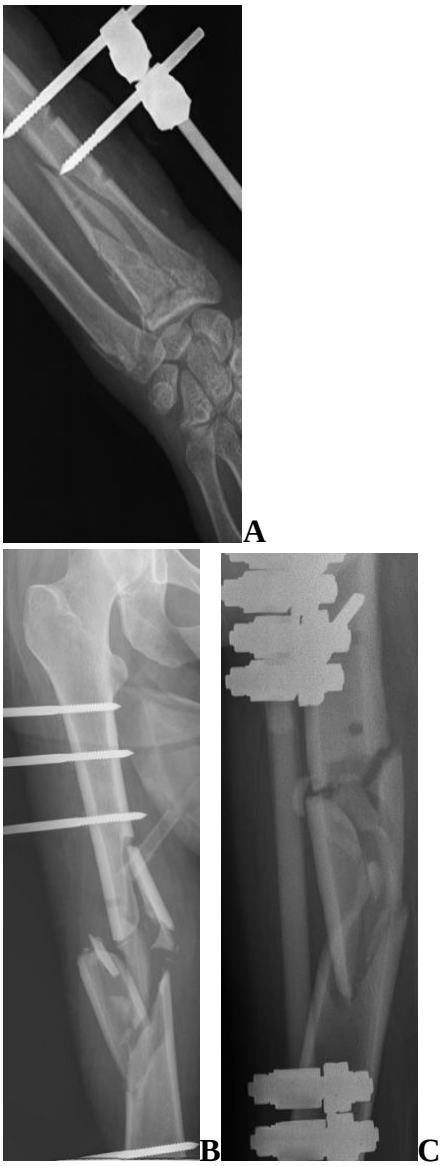

Figure 4. Case 2: Postoperatively imagistic evaluations; A-Distal Radius Stabilization X-ray, B-femur stabilization with an external fixator X-ray

After 4 days the patient was transferred in the orthopedic department where we continued the treatment. Due to the cervical trauma the surgical intervention for intramadulary fixation was delayed. The cervical fracture was immobilized in a Minerva type orthosis.

The patient was discharged but came back after 4 weeks for continuation of treatment when was carried out the removal of the external fixator due to pin tract infection and pin insertion for proximal tibia traction and removal of the external fixator for the distal radius fracture and a orthosis immobilization.

After the treatment of the pin tract holes infection the final surgical step was carried out: open reduction and internal fixation of the femur with a intramedullary long Gamma.

Figure 5. Postoperatively imagistic evaluations; A,B - femur stabilization with Gamma Nail X-ray

The femoral fracture is one of the most frequent and high potential shock generators, orthopedic lesion in polytrauma patients, usually seen in cases of high energy trauma. It requires prompt diagnostic and emergency surgical treatment, due to potentially lethal complications. The correct diagnostic (both clinic and imagistic) is very important, because this type of fracture presents a high bleeding and emboligen risk. The surgical treatment consists of the external fixation of the fracture, respecting the principle of damage control, and after the potentially lethal lesions have been taken care of, the therapeutic conduit can include centromedular or paracortical fixation.

CONCLUSIONS

It is very important in the treatment of the polytrauma patient to have a well-trained interdisciplinary team, able to quickly and accurately assess the patient in order to take the best decisions regarding the therapeutic conduct. The polytrauma patient needs a gradual, long-term and well managed treatment care in order to obtain the best outcome.

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