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Early Definitive Care (EDC) VS Damage Control Orthopedics (DCO) in the Management of Femoral Shaft Fractures in Polytrauma Patients

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Abstract **Original Research Article**

In the case of diaphyseal fractures of long bone, the stabilization of the fracture site must be performed as early as possible as it reduces the risk of complications. However, the realization of a definitive osteosynthesis early, in particular the centromedullary nailing, will be responsible for an additional aggression for the patient, called second hit, which can create or aggravate respiratory or multi-visceral failure. Orthopedic damage control (DCO) is a simple surgical technique that has as a principle, the temporary stabilization of fracture sites by the use of external fixators. DOC reduces blood loss intraoperative, the operative times, and especially the intensity of the surgical aggression source of secondary complications. The broader clinical benefits of DOC compared to permanent early osteosynthesis, however, remain controversial. Most experts still recommend DOC for shocked or severely injured patients. For borderline patients, stable but with a risk of degradation due to surgery, its use remains highly debated. For the less severe patients, DOC is not recommended, except in cases of significant local tissue or bone decay. The initial DOC strategy is associated in most cases with a secondary reoperation to perform definitive osteosynthesis. The definitive osteosynthesis must ideally take place between the 4th and the 15th or 21st day to minimize the local risk or general complications. Thus, the choice of the initial strategy, as the optimal timing of secondary recovery should be discussed between the surgeon and the anesthesist.

Keywords: Fracture, Femur, Nailing, Emergency, Limbs.

INTRODUCTION

The surgical therapeutic strategy for femoral diaphysis fractures in polytraumatized patients has evolved over the years and has led to better results for these patients. However, there is still controversy regarding the optimal treatment strategy and surgical care can differ significantly from country to country and even from hospital to hospital.

We are studying the surgical treatment strategy (Early Definitive Care (EDC) or Damage Control Orthopedics (DCO) implemented in the care of severely injured polytrauma patients with fractures of the femoral shaft treated in IBN SINA Hospital of Rabat, as well as the factors affecting decision-making.

MATERIEL AND METHODS

This retrospective study includes 26 polytrauma patients including 19 men with an average age of 27.8 years admitted to the emergency room of the CHU IBN SINA in Rabat between January 2019 and May 2022, over a period of 3 years and 5 months.

The time between the trauma and admission to the emergency room of the CHU IBN SINA in Rabat varies between 1 hour and 18 hours.

The patients were victims of various road accidents (AVP), defenestration or attempted suicide by falling from a high place or injured by firearm.

They presented different injuries but all had uni or bilateral fractures of the femoral diaphysis which were treated surgically either by EDC or DCO.

Based on their initial surgical management strategy, patients with femoral fracture were divided into EDC and DCO groups and compared.

Patients under 16 years old or with isolated head trauma, dead on arrival and those admitted more than 24 hours after the trauma were excluded.

The severity of the lesions was measured by the New Injury Severity Score (NISS) which was >16 in all polytrauma patients.

Region	Injury Description	AIS	Square Top Three
Head & Neck	Cerebral Contusion	3	9
Face	No Injury	0	
Chest	Flail Chest	4	16
Abdomen	Minor Contusion of Liver Complex Rupture Spleen	2 5	25
Extremity	Fractured femur	3	
External	No Injury	0	
		Injury Severity Score:	50

AIS Score	Injury
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Survivable

Figure 1: New Injury Severity Score (NISS)

RESULTS

The demographic data show a predominance of young male subjects, indeed, 19 (76%) patients were men. The average age was 27.8 years with extremes of 17 to 61 years. All were victims of trauma; the most frequent mechanism was road accidents in 22 cases (88%), then falling from a high place in three cases (11%) and assault by firearm in one case (1%).

The majority (80%) of the patients included underwent EDC: surgical treatment of the fracture by anterograde centromedullary nailing of the femur.

Patients who underwent COD (20%) by external osteosynthesis of the fracture using a Hoffmann +/- pinning type external fixator were significantly more seriously injured (NISS: 40.1 ± 11.5 vs 27.8 ± 10.1, p <0.001) with longer lengths of stay in ICU (15.4 ± 9.8 vs 7.5 ± 6.1 days, p <0.001) and in hospital (29.9 ± 29.6 vs 13.7 ± 11.4 days, p<0.001) than EDC-treated patients.

The decision-making was mainly based on factors related to the fracture, whether it is open (DCO) or closed (EDC), the time to management and immobilization of the fracture and the loco-regional vascular-nervous lesions.

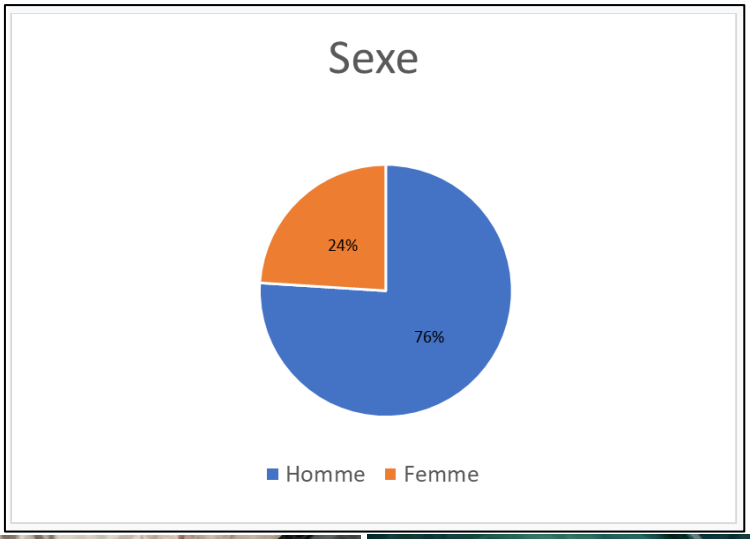
While factors unrelated to the fracture: hemodynamic or neurological instability, may have contributed to the choice of an approach in a small number of cases, which is a more rapid approach.

The patients initially treated with DOC were taken back for conversion to internal osteosynthesis at different times varying between 20 days and 4 months after adequate management of the local infection by surgical dressings and appropriate long-term antibiotic treatment.

Definitive orthopedic treatment with a plaster splint was not considered in any of the patients.

The main complication of the femur fracture (which is a long bone) is the fat embolism syndrome (FES), which was observed in two patients whose time to management was respectively 14 and 18 hours whose one of them was declared dead. The two surgical strategies of the femur fracture were used in the two patients.

Four cases of septic pseudarthrosis were observed in patients, all treated with DCO.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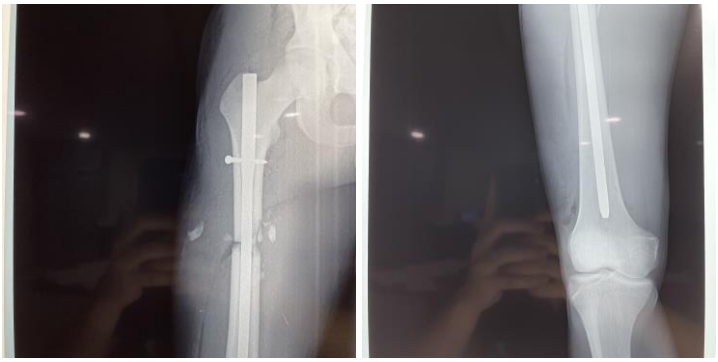

Figure 2: Clinical images and X-Ray for 2 patients with femoral fracture

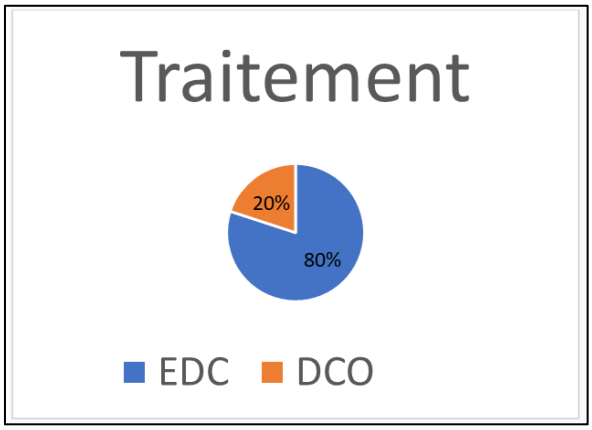

Figure 3: Proportion of EDC and DCO in our patients

DISCUSSION

Fractures of the femoral shaft usually result from high-energy forces and are common injuries in multiple trauma patients. A typical patient is a healthy young man injured in a car accident. The treatment strategy for femoral shaft fractures in polytrauma patients has evolved over the years and has led to better outcomes for these patients. However, there are still controversies regarding the optimal treatment strategy and surgical care may differ significantly from country to country.

Our retrospective study of 26 cases, of which 20 cases were treated by EDC and 6 cases by DCO, confirms the difficulty of having an optimal strategy. Indeed, several factors are taken into consideration: the skin condition next to the fracture, the time taken for management, the lesions associated with the fracture and the hemodynamic and neurological state of the patient.

Until the mid-1970s, long bone fractures in polytrauma patients were mainly treated non-surgically. Starting with Riska *et al.*, showing the benefit of early internal fracture fixation (within two weeks) in these patients, and then subsequent studies supporting the concept of Early Definitive Care (EDC), where definitive fracture stabilization occurred within 24 hours of injury, was born. A better understanding of the pathophysiology of trauma and the development of the "two-shot model" led to Damage Control Orthopedics (DCO) in the late 1990s. DCO involves primary external fixation within the first 24 hours of injury followed by a delayed definitive fixation of the fracture a few days later.

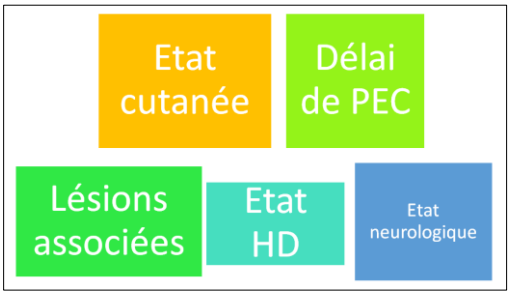

Figure 4: Decision factors for therapeutic management

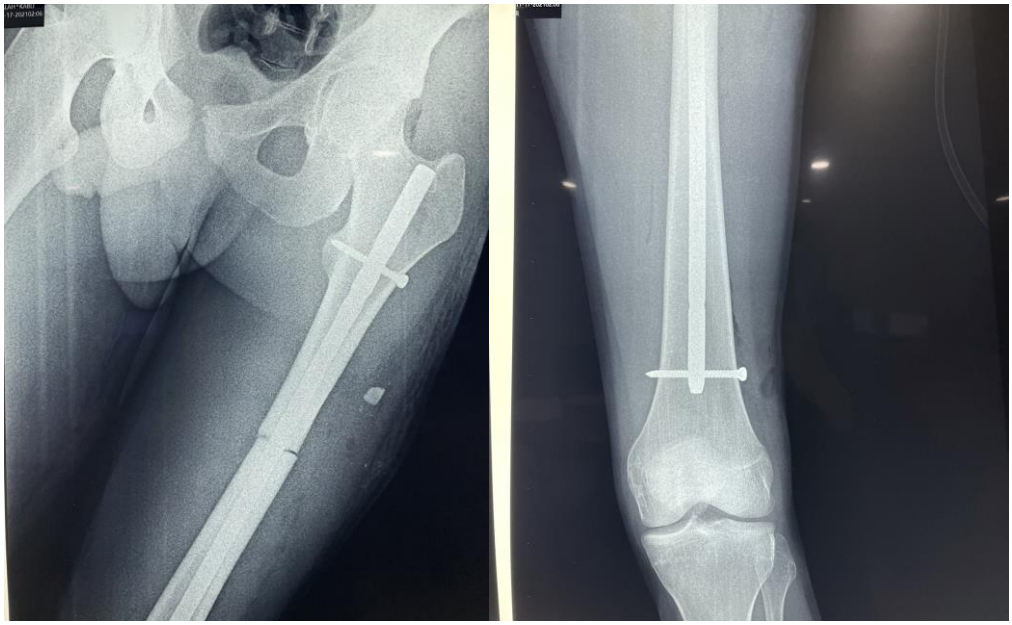

Figure 5: Management of a femur fracture by EDC

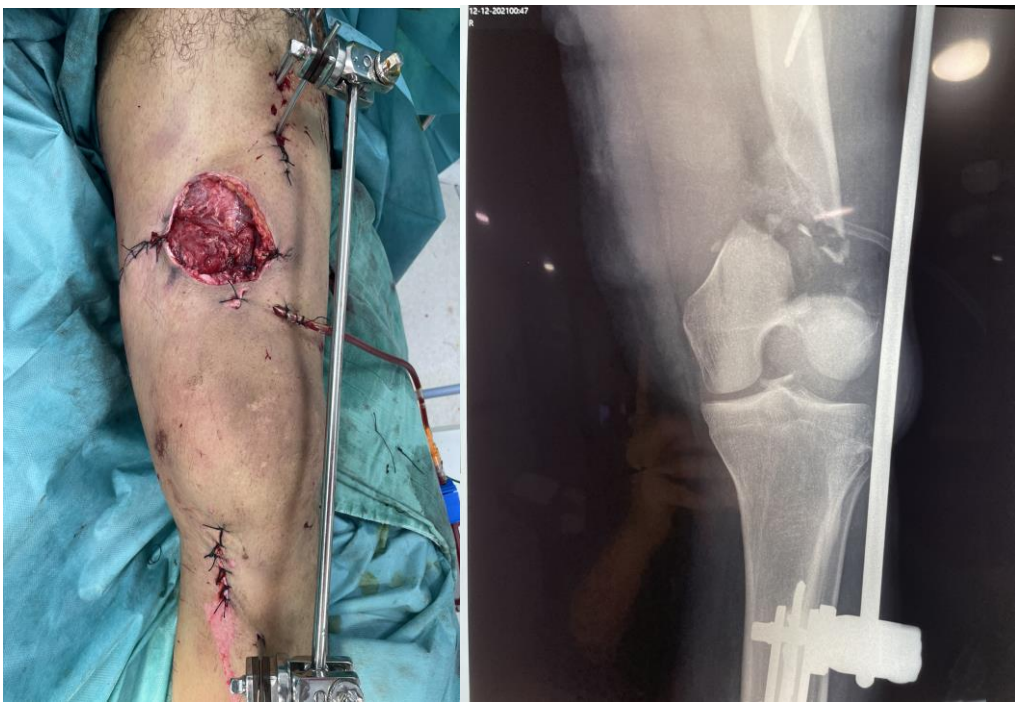

Figure 6: Management of an open fracture of the femur by DCO

CONCLUSION

Early definitive care is the prevailing treatment strategy for patients with severe femoral shaft fracture injuries. Patients treated with the DCO strategy are more severely injured, especially after sustaining more severe intracranial and thoracic injuries. In addition to injury-related factors, decision-making regarding treatment strategy was influenced by non-injury-related factors in only a minority of cases.

For an open CAUCHOIX II or III fracture, in an unstable patient with polytraumatism of the thorax or skull and whose surgical procedure must be rapid: a DCO strategy is best suited.

For an open CAUCHOIX I fracture whose cutaneous opening is far from the point of introduction of the intramedullary nail, or closed fracture, in a polytraumatized patient but whose surgical procedure can exceed 1 hour or 1 hour 30 minutes, an EDC can be undertaken with more encouraging results in terms of complications.

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