

Prognostic Determinants of Post Traumatic Fat Embolism Syndrome: A Retrospective Cohort Study in a Moroccan Intensive Care Unit

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Abstract: *Background:* Fat embolism syndrome (FES) is a rare but potentially life threatening complication of long bone fractures. While its pathophysiology has been widely described, prognostic determinants among critically ill patients remain incompletely defined. *Objective:* To identify clinical, physiological, and therapeutic predictors of mortality in patients admitted to an intensive care unit (ICU) with post traumatic FES. *Methods:* We conducted a retrospective cohort study including 20 consecutive patients diagnosed with FES according to Gurd criteria between January 2021 and May 2025. Demographic variables, trauma characteristics, latency period, respiratory and hemodynamic parameters, laboratory findings, therapeutic interventions, and outcomes were analyzed. Survivors and non survivors were compared using Student t test and Chi square test. *Results:* Overall mortality was 20 percent. Advanced age ($p = 0.013$), comorbidities ($p = 0.013$), delayed initial management ($p = 0.013$), short latent period ($p = 0.013$), development of acute respiratory distress syndrome (ARDS) ($p = 0.032$), and mean arterial pressure less than or equal to 65 mmHg ($p = 0.032$) were significantly associated with mortality. *Conclusion:* Mortality in FES appears primarily driven by patient vulnerability, early fulminant presentation, respiratory failure severity, and circulatory instability. Early recognition and aggressive supportive management remain crucial.

Introduction

Fat embolism syndrome represents the clinical expression of systemic dissemination of fat globules following bone marrow disruption, most frequently after femoral and other long bone fractures. Although microscopic fat embolization is common after trauma, the full clinical syndrome develops in a minority of patients and is characterized by the classical triad of respiratory distress, neurological impairment, and petechial rash [1]. Two complementary mechanisms explain its pathophysiology. The mechanical theory proposes that fat globules enter the venous circulation and obstruct pulmonary microvasculature. The biochemical theory suggests that lipolysis generates free fatty acids, leading to endothelial injury, capillary leak, and systemic inflammatory response [2]. Severe forms may evolve toward acute respiratory distress syndrome, right ventricular dysfunction, and multiorgan failure. Reported mortality ranges between 5 and 20 percent depending on severity and availability of advanced critical care [3,4].

Materials and Methods

This retrospective cohort study was conducted in the ICU of Hassan II University Hospital, Fez, Morocco. Patients admitted between January 2021 and May 2025 with a diagnosis of post traumatic FES according to Gurd criteria were included. Data collected included demographic characteristics, mechanism of trauma, fracture type, comorbidities, latent period, delay in management, respiratory parameters, hemodynamic status, laboratory values, need for mechanical ventilation, vasopressor therapy, ICU length of stay, and survival status. Quantitative variables were expressed as mean plus or minus standard deviation and compared using Student t test. Qualitative variables were analyzed using Chi square test. A p value less than 0.05 was considered statistically significant.

Results

Twenty patients were included; 90 percent were male. Road traffic accidents accounted for 90 percent of injuries. Femoral fractures were present in 80 percent of cases. Overall mortality was 20 percent. Non survivors were significantly older (mean 54.4 versus 28.1 years, $p = 0.013$) and had more comorbidities (75 percent versus 6 percent, $p = 0.013$). Short latent period and delayed management were significantly associated with mortality. ARDS occurred in 25 percent of patients and was strongly associated with death ($p = 0.032$). Hypotension with mean arterial pressure less than or equal to 65 mmHg was also predictive of mortality ($p = 0.032$).

Table 1: Prognostic Factors Associated with Mortality

Variable	Survivors	Non survivors	p value
Mean age (years)	28.1	54.4	0.013

Comorbidities percent	6	75	0.013
Short latent period percent	6	75	0.013
ARDS percent	6.6	60	0.032
MAP less or equal 65 mmHg percent	6.6	60	0.032

Discussion

Our findings reinforce that respiratory failure remains the principal determinant of mortality in fat embolism syndrome. The association between ARDS and death observed in our cohort aligns with prior studies demonstrating that severity of hypoxemia correlates with outcome [3-5]. Advanced age and comorbidities likely reflect reduced physiological reserve and increased susceptibility to systemic inflammatory response [2,6]. The association between short latent period and mortality suggests that fulminant FES represents a severe phenotype characterized by massive embolization and rapid pulmonary microvascular obstruction. Hemodynamic instability probably reflects right ventricular overload secondary to acute pulmonary hypertension and inflammatory vasoconstriction [7,8]. Although laboratory abnormalities were frequent, they did not independently predict mortality.

Conclusion

In this Moroccan ICU cohort, mortality in post traumatic fat embolism syndrome was associated with advanced age, comorbidities, short latent period, ARDS, and hemodynamic instability. Early recognition, lung protective ventilation, and careful hemodynamic stabilization remain essential to improve outcomes in critically ill trauma patients.

References

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