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RESEARCH ARTICLE

RISK FACTORS FOR MORBIDITY AND MORTALITY IN PROXIMAL FEMORAL FRACTURES

Redouane Ahtil, Walid Atmani, Abderrahmane Elwali, Mustapha Bensghir, Khalil Abou Elalaa and Hicham Balkhi

Department of Anesthesiology and Intensive Care, Mohammed V Military Hospital, Faculty of Medicine and Pharmacy Mohammed V University Rabat Morocco.

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Abstract

Proximal femoral fractures (hip fractures) are a major public health concern, particularly in the elderly, due to their high morbidity and mortality rates. This retrospective descriptive study, conducted at the Mohammed V Military Teaching Hospital between January 2018 and June 2021, aimed to identify risk factors for short- and long-term morbidity and mortality in patients over 50 years of age undergoing surgery for proximal femoral fractures. A total of 125 patients were included in the study. The analysis revealed several significant risk factors for morbidity and mortality, including age over 70, anemia, preoperative renal insufficiency, and delayed treatment beyond 48 hours. Multivariate analysis indicated that treatment delay was the only statistically significant factor associated with postoperative morbidity and mortality (p=0.015). Postoperative complications were found to be associated with neurological, cardiovascular, respiratory, thromboembolic, and chronic pain, with significant relationships to anesthesia techniques, prolonged hospitalization, and pre-existing comorbidities. In-hospital mortality was 4%, with a 3-month mortality rate of 8.8% and a 1-year mortality rate of 20.8%. The study highlighted the impact of early surgical intervention, revealing that a delay in treatment by more than 48 hours was associated with a higher risk of complications and mortality. Furthermore, the study explored the influence of anesthesia techniques on patient outcomes, noting a slightly higher incidence of mortality in patients receiving general anesthesia compared to spinal anesthesia, though the difference was not statistically significant. The findings emphasize the importance of early intervention, identification of risk factors, and the need for multidisciplinary care to improve patient outcomes and reduce the burden of these fractures on healthcare systems.

Introduction:-

Fractures of the proximal femur, commonly referred to as hip fractures, are a significant public health concern, particularly among the elderly population. These injuries are not only prevalent but also associated with high morbidity and mortality rates. The aging demographic is increasingly vulnerable to such fractures due to a combination of factors, including decreased bone density, increased fall risk, and the presence of comorbid

Corresponding Author:- Redouane Ahtil
Address:- Department of Anesthesiology and Intensive Care, Mohammed V Military Hospital, Faculty of Medicine and Pharmacy Mohammed V University Rabat Morocco.

conditions. Globally, more than 1.6 million individuals experience a proximal femoral fracture annually, with this number projected to rise as the population ages. The consequences of these fractures extend beyond the immediate physical injury, often leading to prolonged hospitalization, loss of independence, and significant healthcare costs. Studies have shown that the mortality rate within the first year following a hip fracture can be alarmingly high, with estimates ranging from 24% to 28% depending on the fracture type and patient characteristics.[1]

The risk factors contributing to increased morbidity and mortality in patients with proximal femoral fractures are multifaceted. Age plays a critical role, with older adults—particularly those over 70 years—facing significantly higher risks, and mortality rates increasing notably in patients aged 90 years and above [2].Gender differences have also been observed, with males generally exhibiting higher mortality rates compared to females after sustaining similar injuries [3].Additionally, comorbidities such as chronic obstructive pulmonary disease (COPD), diabetes mellitus, congestive heart failure, and dementia have been linked to poorer outcomes post-fracture[1]. Functional status is another important determinant, as pre-existing limitations in mobility or activities of daily living exacerbate recovery challenges and increase mortality risk [4.] Moreover, delays in surgical intervention and postoperative complications, such as pneumonia or delirium, further elevate mortality risks[5].

Understanding these risk factors is crucial for healthcare providers in managing patients with proximal femoral fractures effectively. Early identification and intervention strategies tailored to individual risk profiles may help mitigate the high mortality associated with these injuries. In conclusion, proximal femoral fractures represent a critical area of focus in geriatric medicine due to their association with significant morbidity and mortality. A comprehensive understanding of the contributing factors is essential for improving patient outcomes and reducing the burden on healthcare systems.

Materials And Methods:-

This retrospective descriptive study was conducted on patients over 50 years of age who underwent surgery for proximal femoral fractures at the Mohammed V Military Teaching Hospital between January 2018 and June 2021. The study aimed to identify risk factors for short- and long-term morbidity and mortality in these patients. Inclusion criteria comprised patients aged over 50 years who underwent surgery for femoral neck, intertrochanteric, or subtrochanteric fractures during the study period, while exclusion criteria included patients under 50 years, proximal femoral fractures associated with major trauma, and unusable clinical records. Data were collected using tailored forms based on clinical records from the orthopedic and trauma departments, hospitalization registers, anesthesia records, anesthetic monitoring sheets, and telephone interviews with patients and their families. Qualitative variables were expressed as frequencies and percentages, and quantitative variables as means ± standard deviations. Statistical analysis was performed using SPSS Version 27, with a p-value < 0.05 considered statistically significant.

Results:-

Risk factors for morbidity and mortality:

During the study period, 218 patients underwent surgery for proximal femoral fractures (PFF), with 79 patients under 50 years of age and 14 patients with incomplete data excluded, resulting in 125 patients included in the study. The findings indicated several significant risk factors for morbidity and mortality postoperatively in univariate analysis: age over 70, anemia, preoperative renal insufficiency, antithrombotic use, treatment delay greater than 48 hours, high ASA score, and perioperative bleeding. Multivariate analysis identified treatment delay as the only statistically significant factor (p=0.015) associated with postoperative morbidity and mortality. Table 1

Variables	Univariate Analysis			Multivariate Analysis		
	OR brut	IC (95%)	P	OR brut	IC (95%)	P
Demographic Factors						
- Age > 70 ans	2,240	(1,084-4,628)	**0,029**	1,344	(0,574-3,146)	0,496
- Sex	0,971	(0,471-2,003)	0,936			
Preoperative Factors						
- Hypertension	2,051	(0,930-4,525)	0,075			
- Diabetes	1,873	(0,784-4,475)	0,158			
- Coronary history	1,457	(0,442-4,798)	0,536			

-	Other heart diseases	6	(0,651-55,329)	0,114			
-	PE (Pulmonary Embolism)	2,880	(0,254-32,629)	0,393			
-	Neurological history	1,188	(0,342-4,122)	0,789			
-	LVEF < 40%	6	(0,651-55,329)	0,114			
-	Cancerous disease	2,958	(0,521-16,795)	0,221			
-	Preoperative anemia	3,822	(1,430-10,218)	**0,008**	2,938	(0,798-10,816)	0,105
-	Renal failure	13,09	(1,583-108,238)	**0,017**	6,173	(0,687-55,508)	0,104
-	Antithrombotic therapy	5,175	(1,564-17,126)	**0,007**	3,636	(0,753-17,555)	0,108
-	Consultation after 24 hours	2,084	(0,976-4,452)	0,058			
-	Delay in management > 48 hours	3,257	(1,497-7,089)	**0.003**	3,122	(1,246-7,822)	**0,015**
-	Site : femoral neck	1,689	(0,779-3,660)	0,184			
-	Site : Per trochanter	0,603	(0,274-1,327)	0,209			
-	Site : Sub trochanter	0,696	(0,061-7,885)	0,770			
-	ASA score > 2	3,019	(1,683-5,415)	**<0,001**	1,383	(0,602-3,182)	0,445
Perioperative and Postoperative Factors							
-	Anesthetic technique	0,881	(0,432-1,796)	0,727			
-	Hypotension	1,403	(0,650-3,026)	0,388			
-	Blood loss	3,610	(1,047-12,449)	0,042	0,103	(0,505-7,990)	0,322
-	Duration of surgery	1,006	(0,999-1,013)	0,095			

Table 1:- Risk Factors Associated with Clinical Outcomes: Univariate and Multivariate Analysis.

Risk factors for postoperative morbidities included:

Risk factors for postoperative morbidities included several independent associations: neurological complications were linked to general anesthesia (p=0.024), postoperative pain (p=0.005), and prolonged hospitalization (p=0.004); cardiovascular complications were associated with preoperative anemia (p=0.05) and prolonged hospitalization (p=0.048); respiratory complications were linked to admission to intensive care (p=0.05) and prolonged hospitalization (p=0.005); thromboembolic complications were significantly associated with a history of stroke (p=0.02), femoral neck fractures (p=0.045), and prolonged hospitalization (p=0.022); and chronic pain was independently associated with recurrence of surgery at the same site (p=0.03).

Risk Factors for Mortality

In-hospital Mortality

The in-hospital mortality rate in our study was 4%. Statistically significant differences were found in the univariate analysis for: history of thromboembolic disease, history of COPD, hemostasis disorders, ASA score >2, subtrochanteric fracture location, admission to intensive care, and postoperative respiratory, thromboembolic, and hematological complications. No significant differences were found in the multivariate analysis.

Month Mortality

The 3-month mortality rate was 8.8%. Statistically significant differences were observed in the univariate analysis for: history of thromboembolic disease, history of heart disease, preoperative dyspnea, use of antithrombotics, high ASA score, biological abnormalities, intraoperative hypotension, intraoperative transfusion, length of hospitalization, and postoperative comorbidities (cardiovascular, respiratory, thromboembolic). In the multivariate analysis, only the length of hospitalization and postoperative complications (CRPO) were retained as independent factors.

One-yearmortality

The one-year mortality rate was 20.8%. A significant difference was observed in patients with the following characteristics: high ASA score, Fe VG < 40%, delayed consultation or management, and perioperative hypotension.

Table 2:- Univariate and Multivariate Analysis of Factors Associated with Mortality and Complications in Patients Undergoing Surgery.

Variables	P value	P value
Demographic Factors		
Sex	0,384	
Age	0,136	
Preoperative Factors		
Hypertension	0,547	
Diabete	0,964	
Coronary history	1	
Other cardiopathies	0,107	
History of thromboembolic disease	0,001	0,998
Neurological history	1	
COPD	0,024	1
LVEF < 40%	1	
Coagulation disorders	0,002	0,998
Cancer	1	
Use of antithrombotics	0,627	
Delay in care > 48h	1	
Fracture site: Femoral neck	0,058	
Fracture site: Per trochanter	0,180	
Fracture site: Subtrochanter	0,042	1
Preoperative anemia	0,203	
Lack of autonomy	0,435	
Score ASA > 2	0,004	0,987
Perioperative and Postoperative Factors:		
Anesthetic technique	0,716	
Hypotension	0,610	
Transfusion	0,627	
Blood loss	0,058	
Surgical duration	0,815	
Total Hip Prosthesis (PTH)	0,161	
Proximal Intermediair prothesis (PIH)	1	
Ostéosynthesis	0,062	
Postoperative anemia	0,009	0,995
Postoperative thromboembolic event (MTE)	<0,001	0,987
Postoperative chronic pain (CRPO)	<0,001	0,991
Admission to ICU	<0,001	0,990
Hospital Length of Stay	0,107	

Impact of Delay in Management

We observed that early management was generally associated with a more favorable outcome. A delay in management of more than 48 hours was statistically associated with a higher risk of complications (41.9% vs 21.6%, p = 0.021) and one-year mortality (28.4% vs 9.8%, p = 0.014).
A delay of more than 48 hours was also associated with a higher risk of in-hospital mortality and three-month mortality, but the difference did not reach statistical significance (p = 0.080 and p = 0.648).

Table 3:-

	DeLay of care		p-value
	<48 hours	**>48 hours**	
Late Complications	21,6%	41,9%	0,021

Chronic Pain	15,7%	21,6%	0,492
Failure of Osteosynthesis Material	0,0%	6,8%	0,079
Site Infection	2,0%	2,7%	1,000
In-Hospital Mortality	0,0%	8,1%	0,080
Mortality within 3 Months	2,0%	5,4%	0,648
Mortality at 1 Year	9,8%	28,4%	0,014

Table 3:- Association Between Delay in Care and Postoperative Outcomes

Impact of Anesthetic Technique

Intra-Hospital Mortality

The study of the association between anesthetic technique and the incidence of mortality showed that the occurrence of in-hospital death was slightly higher in patients undergoing general anesthesia (4.6%) compared to those receiving spinal anesthesia (3.3%). This difference was not statistically significant (p = 0.716; OR = 0.713; CI [0.115-4.419]). Table 4

Mortality at 30 Days, 3 Months, and 1 Year

The 30-day mortality was higher in the general anesthesia group (6.1%) compared to the spinal anesthesia group (5%). The same trend was observed at 3 months (12.3% vs. 6.67%; p = 0.367). Mortality at 1 year was more favorable for the spinal anesthesia group, although this difference was not statistically significant (p = 0.378). Table 4

Perioperative and Postoperative Complications

Anemia was more common in patients who underwent surgery under general anesthesia, but this association was not statistically significant (18.5% vs. 6.7%, p = 0.062). Cognitive disorders were more frequent in patients operated under general anesthesia (20% vs. 6.7%, p = 0.037). There were no significant differences in the occurrence of other complications (chronic postoperative pain, thromboembolic diseases, metabolic and electrolyte disorders, infections).Table 4

	Type of Anesthesia		p-value
	General Anesthesia	**Spinal Anesthesia**	
Hypotension	41,5%	18,3%	0,006
Use of Vasopressors	10,8%	0,0%	0,014
Anemia	18,5%	6,7%	0,062
Postoperative respiratory Complications	4,6%	1,7%	0,620
Cognitive Disorders	20,0%	6,7%	0,037
Thromboembolic Diseases	4,6%	6,7%	0,709
Chronic Pain	15,4%	23,3%	0,364
Infection	1,5%	3,3%	0,607
Failure of Osteosynthesis Equipment	3,1%	5,0%	0,670
in-hospital Mortality	4,6%	3,33%	0,716
30-day Mortality	6,1%	5,0%	1,000
3-month Mortality	12,3%	6,6%	0,367
1-year Mortality	24,6%	16,7%	0,378

Table 5:- Comparison of Perioperative Outcomes by Type of Anesthesia.

Discussion:-

Proximal femur fractures represent a significant public health issue. They are associated with high morbidity and mortality rates, creating a considerable economic burden [6]. Worldwide, nearly 1.6 million patients suffer from hip fractures each year, and this number is increasing by 25% every decade due to the aging population [7]. Gullberg et al. estimate that by 2050, 4.5 million people will be affected by hip fractures globally [8]. The management of hip fractures requires a multidisciplinary approach. Recent Italian recommendations advise a team consisting of an orthopedic surgeon, an anesthesiologist, and a geriatrician [9]. In the postoperative phase, the contribution of a psychiatrist and physiotherapist is necessary.

Numerous publications focus on the perioperative management of these patients to reduce the mortality rate, which remains very high despite ongoing improvements in practices [10]. The main challenge lies in identifying the risk factors for morbidity and mortality, an essential approach to guide therapeutic management.

The mortality rate remains high even after surgery, with more than one in four patients dying approximately one year after a hip fracture [11]. Literature data show a lower incidence in the African population compared to the Caucasian population [12].

Risk Factors for Postoperative Morbidity:

Neurological Morbidity:

Postoperative cognitive dysfunction (POCD) is the most frequent complication in elderly patients, with an incidence exceeding 40% in some reports [13]. The literature distinguishes two nosological entities [13]:

- Delirium, which is an acute and transient symptom.
- Cognitive dysfunction, which more subtly and long-term affects the cognition of elderly patients.

In our study, the incidence of postoperative cognitive dysfunction was 13.6%. It was higher among patients operated under general anesthesia, with a statistically significant difference (p=0.037).

Predisposing factors, according to the literature, include sensory abnormalities, physical disability or comorbidity, early cognitive disorders, dehydration, hypotension, and anemia. Precipitating factors are physical restraint, malnutrition, polypharmacy (more than three medications), pain, urinary retention, and postoperative complications [9]. In our study, postoperative cognitive dysfunction was also associated with prolonged hospital stay (p=0.004) and the presence of chronic pain (p=0.005). Risk factors for POCD related to anesthesia include hypoxia and hypotension, which can lead to a decrease in cerebral perfusion.Cerebrovascular accidents (CVAs) represent the second most common neurological complication in our study. Their incidence did not depend on the anesthesia technique. Two retrospective observational studies [14-15], which evaluated theincidence of strokes after hip fracture surgery in geriatric patients, found no significant difference between general anesthesia and regional anesthesia (OR = 1.08; 95% CI 0.82-1.4).

Cardiovascular Morbidity:

The prevalence of cardiovascular diseases increases with age, with a cardiovascular condition present in 52% of patients over 75 years old [16]. This explains why the prevention of cardiovascular complications is a crucial issue in the perioperative management of elderly patients.The prospective ESCORTE study showed that elderly patients have comorbidities and a high risk of postoperative morbidity and mortality, mainly due to cardiovascular complications [17]. In our study, these cardiovascular complications represented a rate of 16.8%. The factors associated with cardiovascular complications after logistic regression were the length of hospital stay (p=0.048) and preoperative hemodynamic status, such as anemia (p=0.005).

In a study conducted in France, the authors found that the incidence of postoperative cardiovascular diseases could reach 29%. In a Moroccan study conducted in Marrakech [18], the authors identified three independent prognostic factors for the occurrence of cardiac complications: age ≥ 85 years, history of heart disease, and ASA class 3. In a Korean study by Kim SD and al. [19], the prognostic factors for postoperative cardiac morbidity in patients undergoing surgery for cervical fractures were identified as ASA class 3, atelectasis, and a surgical duration longer than 90 minutes.

Respiratory Morbidity:

Ventilatory system alterations related to physiological aging may go unnoticed in the preoperative phase but may only appear during the postoperative period. Postoperative pneumonia is primarily dominated by atelectasis. In our series, respiratory complications occurred significantly among patients with prolonged hospital stays (p=0.005) and those admitted to the ICU (p=0.05). These complications are therefore related to prolonged bed rest and immobilization. These results emphasize the need for early mobilization of postoperative patients.

In the study by Kim SD et al. [19], the incidence of postoperative pneumonia was 33.2%, which is much higher compared to our incidence of 4.8%. They found that the prognostic factors for respiratory morbidity were age, male gender, and ASA class 3.

Thromboembolic Complications:
Major orthopedic surgery is the most thrombotic type of surgery. The thromboembolic risk is twice as high as in general surgery and 3 to 4 times higher than in gynecological surgery. In our series, 7 cases of thromboembolic accidents were noted, accounting for 5.6%, including 2 pulmonary embolisms that required ICU admission and led to death. This result is almost similar to the findings in the literature. An Australian study conducted in 2015 reported a thromboembolic complication rate of 6.7% [20]. Thromboembolic prevention should be extended in the postoperative phase.

Risk Factors for Postoperative Mortality:
Over the past 30 years, the mortality rate for FESF (Femoral Neck Stress Fractures) has not significantly decreased. Beginning in the 2000s, studies reported a mortality rate around 21% [21].

In our study, the mortality rate was 4% in-hospital, 4.8% at 30 days, 8.8% at 3 months, and 20.8% at 1 year, which is comparable to the results reported in the literature (Table 5). In a retrospective American study involving 32,135 elderly patients, the in-hospital mortality rate was 2.3%, rising to 10% at 30 days and 30% after one year [25].

In our analysis, various factors independently associated with mortality were identified after logistic regression: delayed management, particularly late consultation ($p = 0.017$), and an ASA score greater than 2 (OR: 3.41; CI: 1.47-7.90; $p = 0.004$).

A prospective study conducted in Italy found five prognostic factors related to mortality: high ASA score, prolonged hospitalization, degree of osteoporosis, female gender, and advanced age [26].

Another study conducted in the United States found that prognostic factors associated with mortality included age, body mass index (BMI), gender, race, active smoking, ASA score, dyspnea, functional and neurological status [27].

Study		Type	One Year Mortality
Taylor and al. (2012) [22]	2006 to 2008	Randomized Prospective Study, Mean age = 85 years, n = 160	30%
Lo JC and al. (2015) [23]	2000 to 2010	Retrospective Cohort Study, Women, Age > 65 years, US database: n = 13550	22,8%
Ireland AW and al. (2015) [24]	2008 to 2009	Retrospective Cohort Study, Mean age = 87 years, Australian database: n = 2552	34%
Az-Eddine Djebara and al. [10]	01/06/2016 to 31/10/2017	Prospective Observational Cohort, Mean age = 82 years, n = 170	25,3%
Our Study	January 2018 to June 2021	Descriptive Retrospective Study, n = 125	20.8%

Table 5:- One-Year Mortality Rates in Different Studies on Femoral Neck Stress Fractures (FESF).

Impact of Treatment Delay:
The ideal delay for managing Femoral Neck Stress Fractures (FESF) has been widely debated. However, there seems to be a consensus on the need for prompt intervention.

In a meta-analysis including 35 studies with 191,873 patients, Moja et al. found a significant reduction in mortality with early surgery (<48 hours) (OR = 0.74) [26]. Similarly, Colais et al. demonstrated the same finding in a retrospective study involving over 400,000 patients, with a Hazard Ratio of 0.83 [29]. Additionally, Parker et al., in their literature review on morbidity and mortality factors, identified only two factors that helped reduce mortality rates: the surgeon's experience and the surgical delay (OR = 1.36; $p = 0.06$) [30].

In our study, multivariate analysis identified the treatment delay as the only statistically significant factor ($p = 0.015$) influencing the occurrence of postoperative morbidity and mortality.

Conclusion:-

Proximal femoral fractures in the geriatric population pose significant challenges in terms of both treatment and recovery. Surgical intervention remains the primary approach to restore mobility and reduce mortality. However, these fractures often lead to serious complications, such as infections and thromboembolic events. The anesthesiologist plays a crucial role in the perioperative management, ensuring patient safety through preoperative assessment of risks, optimal anesthesia management, and postoperative care to minimize complications. A multidisciplinary approach, involving anesthesiologists, surgeons, and rehabilitation specialists, is essential for improving patient outcomes. Further research should focus on refining surgical techniques and preventive strategies to reduce postoperative complications.

Consent

As per international standard or university standard, patient's consent has been collected and preserved by the authors.

Ethical Approval

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

Competing Interests

Authors have declared that no competing interests exist.

Methods:-

Use of Large Language Models (LLMs):

In conducting this review, we employed Large Language Models (LLMs), specifically ChatGPT, developed by OpenAI. LLMs were utilized to generate text in sections where comprehensive analysis or discussion was required, such as the introduction, discussion, and conclusion. It's important to note that LLMs function as AI-driven text generation tools and do not constitute traditional authorship. Consequently, the text generated by LLMs was reviewed and edited by the authors to ensure accuracy, coherence, and alignment with the objectives and scope of this review.

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