ACE Inhibitor and Angiotensin Receptor Blocker Fat Embolism Syndrome Prophylaxis

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Introduction

- The clinical manifestations of Fat Embolism Syndrome (FES): hypoxia (96%), tachycardia (93%), fever (70%), unexplained anemia (67%), mental status changes (59%), petechiae (33%), and death (10-15%) of patients[1].
- Embolization of bone marrow fat is a nearly inevitable consequence of long bone fractures[2]
- Approximately 90% of fat embolism syndromes occur after blunt trauma complicated by long-bone fractures[3]
- Specific medical therapy for fat emboli and fat embolism syndrome do not exist at this time and supportive measures have not been tested in adequate randomized controlled trials.
- In April 2013, UMKC affiliated researchers found that lung damage in rats with drug-induced fat embolism is less severe when angiotensin blocking drugs including captopril or losartan or aliskiren are administered[4, 5]
- **We hypothesize that ACE Inhibitors and Angiotensin Receptor Blockers will have similar effects in humans and may be utilized as a prophylactic medication.**

Methodology

- We identified patients diagnosed with fracture of long bone or the pelvis and incidence of fat embolism with International Classification of disease (ICD-9-CM, ICD-10-CM).
- National Drug Codes (NDC) identified group of ACE inhibitor or an ARB.
- The longitudinal patient data is systematically extracted from the participating hospital in EHR and includes encounter data (emergency, and inpatient).
- Encounters between 2013 and 2016 were used in the analysis..
- We gathered study population from the Cerner National Data Warehouse Health Facts, a multi-institutional, geographically, and socioeconomically diverse, HIPAA-compliant, de-identified patient database.

Results

- Statistical analysis was performed using Chi-square and Fisher's exact tests to compare categorical variables. Multivariate logistic regression model was used to create a prediction model incorporating all variables that showed a significant p-value in bivariate analysis.
- Treatment group exhibited significantly lower incidence of fat embolism syndrome compared to the control i.e. 0.31% VS 0.45%.
- Females exhibited significantly lower incidence of fat embolism syndrome compared to the males i.e. 0.34% VS 0.59%.
- Bivariate analyses were conducted to examine the association between potential predictors for fat embolism (Table 1). Significant predictors and demographic were entered in the logistic regression model to examine the contribution for predicting fat embolism

Table 1: Demographic and bivariate results

	N (%)	Fat Embolism (%)	No Fat Embolism (%)	p-value
	(n=135902)	(n=582)	(n=135320)	
Treatment				0.0077
Treatment	19233(14.15)	60 (0.31)	19173(99.69)	
No Treatment	116669(85.85)	522 (0.45)	116147 (99.55)	
Gender				<.0001
Male	47528(34.97)	281(0.59)	47247(99.41)	
Female	88374(65.03)	301(0.34)	88073(99.66)	
Age	68.77(18.98)	56.95 (22.04)	68.82 (18.95)	<0.0001
Race/ethnicity				<0.0001
White	113349 (83.40)	384 (0.34)	112965(99.66)	
Non White	22553 (16.60)	198 (0.88)	22355 (99.12)	

Table 2: Logistic regression results

	Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Age	0.973 (0.969, 0.977)*	0.975 (0.971, 0.979)*
Gender	1.710 (1.479, 2.048)*	1.255 (1.057, 1.490)*
Treatment	0.696 (0.533, 0.910)*	0.979 (0.744, 1.289)

* P-value <0.05 is considered significant

Summary/Conclusion

- Patients were 65.03% female, 83.40 % White, 7.6% Black, 0.4% Hispanic, 1.5% Asian, and 1.3% Native American. Caucasians were at higher risk of fat embolism syndrome than African Americans, Hispanics, and Native Americans.
- There is a statistically significant difference between the treatment and non-treatment groups (0.31% vs 0.45%, p-value of .0077). Males exhibited significantly higher rate of fat embolism syndrome compared to the females (0.59% vs 0.34%). FES most commonly affected patients at younger age. Results from multiple logistic regression shows that after controlling for treatment, with one-year increase in age the incidence of fat embolism syndrome will decrease by 2.5%.
- When treatment group, gender and age are included in multiple logistic regression model, treatment becomes non significant and gender and age is still highly significant. Gender and older age predict risk of fat embolism.
- Since the adjusted odds-ratio is not significant, the original hypothesis is not supported, probably because of the effect of older age on osteoporosis and hypertension which the young group would not have in such frequency.
- A limitation of this study is the fact that data was sourced from EMR. Diagnosis codes used for billing have low specificity and often code for multiple diseases, some of which do not have a fat embolism etiology.

References

1. Fabian, Timothy C. “Unraveling the Fat Embolism Syndrome.” *N Engl J Med.* 1993; 329: 961-63
2. Mellor, A et al. “Fat Embolism” *Anaesthesia*. 2010; 56: 145-54
3. Tanner B et al. “Fat Embolization in Trauma Facilities” *Ann Emerg Med.* 1990; 19: 57
4. Fletcher AN et al. “The Renin Inhibitor Aliskiren Protects Rat Lungs From the Histopathologic Effects of Fat Embolism” *J Trauma Acute Care Surg*. 2017; 82:338-44
5. McIff T.E., Poisner A.M., Herndon B., Lankachandra K., Molteni A., Adler F. Mitigating effects of captopril and losartan on lung histopathology in a rat model of fat embolism. J Trauma. 2011;70:1186–1191.

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