Traumatic Heterotopic Ossification and Risk Factor Analysis in a Civilian Cohort

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Introduction

Traumatic heterotopic ossification (HO) is a known complication after orthopaedic trauma. A number of risk factors contributing to HO development have been identified, and many are nonspecific inflammatory markers or, alternatively, specific biochemical markers not practical for risk assessment in a trauma setting. White blood cell and platelet count were selected biomarkers along with BMI and glucose which serve as a proxy for evidence of a metabolically dysregulated state.

The authors of this study hypothesize that increased baseline levels of inflammation may contribute to the overall risk of HO formation. The study describes traumatic HO within a regional civilian orthopaedic population and seeks to identify a set of inflammation-related biomarkers that may be useful in identifying and stratifying the risk of traumatic HO formation in a rapid and monetarily efficient manner.

Methods

- An electronic medical record database search was performed to identify HO patients in a musculoskeletal (MSK) injury sample from a regional hospital system.
- 522 patients identified from six International Classification of Diseases 9th Revision (ICD-9) codes. Three codes were specific for HO and three codes were non-specific for MSK injury associated with calcification. The nonspecific MSK injury codes were evaluated to increase the sensitivity of HO patient identification.
- To meet inclusion criteria, each patient had to have objective evidence of HO. A subsequent chart was performed on all HO cases for an associated traumatic event.
- Selected biomarkers and BMIs collected at the date of trauma, or as close to the trauma date as recorded. For cases that did not have an identifiable traumatic event, laboratory values taken at the time of orthopaedic procedure.

Patient Demographics

Table 1: Demographic characteristics of overall matched patients and by group: 1:4 match.

	Overall	HO	No HO
Gender		---------- % (N) ----------	
Male	*67.0 (152)*	68.8 (33)	66.5 (119)
Female	33.0 (75)	31.2 (15)	33.5 (60)
Race			
Caucasian	37.4 (85)	35.4 (17)	38.0 (68)
African American	*61.7 (140)*	60.4 (29)	62.0 (111)
Other	0.9 (2)	4.2 (2)	0 (0)
		---------- mean (SD) ----------	
Age, years		45.2 (13.5)	45.7 (13.5)

Biomarker Analysis: HO vs No HO

Table 2: Biomarkers used for analysis in comparing cases and controls with associated mean and SD.

Biomarker	HO	No HO
	-------- mean (SD) --------	
BMI (kg/m^2)	29.4 (7.9)	29.2 (7.4)
WBC (x10^3/μL)	8.0 (3.4)	8.7 (3.5)
Platelet (x10^9/L)	285.6 (121.0)	250.5 (93.0)
Glucose (mg/dL)	104.6 (28.1)	124.5 (87.2)

Biomarker Univariate Risk Analysis

Table 3: Univariate odds ratio (OR) and associated 95% confidence intervals (95% CI) of confirmed HO by biomarker

Biomarker	OR	(95% CI)	P - value
BMI (kg/m^2)	1.019	(0.969, 1.072)	0.4562
WBC (x10^3/μL)	0.939	(0.837, 1.054)	0.2870
Platelet (x10^9/L)	*1.004*	*(1.000, 1.007)*	*0.0436*
Glucose (mg/dL)	0.994	(0.984, 1.003)	0.2071

Trauma Results

- 48 Total Confirmed HO Cases (9.2% overall)
- 33 Confirmed Traumatic Etiology (6.3% overall, 69% of HO cases)
- Traumatic Insult: Falls (9), MVA (9), GSW (3), other (12)
- Anatomic Location: Hip/Pelvis (11), Elbow (6), Shoulder (4), Ankle (3), Knee (3), other (6)

Conclusions

- This paper describes a sample of civilian orthopaedic patients with traumatic heterotopic ossification. The the frequency and anatomic location of the HO is consistent with similar, previous studies. The hypothesis that increased baseline levels of inflammation correlating to increases in the traumatic HO frequency was not observed in this study sample.
- Analysis indicating *Platelet Count* as a statistically significant risk factor associated with HO development is consistent with previous studies showing biological factors within platelets contribute to HO formation.
- This study did not identify an increase in BMI to be associated with higher rates of HO formation.
- Future studies elucidating a relationship between inflammation and the tendency to form HO should focus on biomarkers that can better differentiate between the acute inflammatory response associated with trauma and chronic inflammatory states.

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