Initial Lactic Acid Level Is Associated with Longer and More Expensive Hospital Stays for Lower Extremity Long Bone Fractures

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Purpose: Lactic acid is well studied in the trauma population, and is frequently used as a laboratory value that correlates with resuscitation status and has thus been associated with patient outcomes. There is no literature that assesses the direct association of initial lactate level with hospital costs. We hypothesized that initial lactate levels would be associated with higher rates of ICU utilization and longer and more expensive hospital stays.

Methods: All trauma activations that underwent operative fixation of their tibia and/or femur at our institution from May 2018 to August 2020 were included. Patients who did not have a lactic acid level drawn at the time of their presentation were excluded. Cohorts were divided based on their initial lactate level into normal (<2.5), intermediate (2.5-4.0), and high (>4.0). Data on surgical timing, hospitalization costs, length of stay, and discharge disposition were collected from the electronic medical record. Patients were further evaluated based on the mechanism of their trauma: ballistic, motor vehicle accident (MVA), or other. Analysis of variance (ANOVA) tests were used to compare between groups, and t tests used for individual cohort comparisons.

Results: 401 patients were included. They averaged 34.1 ± 13.0 years old, remained hospitalized for 8.8 ± 9.5 days, and 35.2% required ICU care during their hospitalization. 31.2% of the injuries resulted from ballistic trauma, and 13.8% had multiple operative fractures of the lower extremity. Patients with high lactic acid levels had significantly higher time to surgery ($P = 0.012$), hospitalization costs ($P<0.001$), and length of stay ($P<0.001$). These trends were consistent when cohorts were subdivided by injury. Lactate levels were higher in the ballistic cohort (4.03 ± 2.42) than in the blunt trauma cohort (3.39 ± 1.85) ($P = 0.004$).

	Length of Stay (Days)	Hospital Costs ($1K)	Time to Surg (Hours)
All Patients (n=401)	**8.82 ± 9.53**	**267 ± 283**	**37.4 ± 56.1**
Normal Lactate (<2.5)	6.95 ± 5.95	204 ± 189	31.9 ± 48.8
Intermediate Lactate (2.5-4.0)	7.76 ± 7.53	230 ± 225	29.3 ± 32.1
High Lactate (>4.0)	11.91 ± 13.12	364 ± 379	51.4 ± 76.8
p-value (ANOVA)	*<0.001*	*<0.001*	*0.002*
Polytrauma (n=55)	**13.8 ± 8.0**	**463 ± 313**	**50.6 ± 60.0**
Normal Lactate (<2.5)	11.57 ± 7.11	358 ± 329	44.1 ± 62.5
Intermediate Lactate (2.5-4.0)	12.62 ± 7.21	408 ± 213	37.1 ± 32.6
High Lactate (>4.0)	16.75 ± 8.76	601 ± 337	68.2 ± 73.9
p-value (ANOVA)	*0.106*	*0.039*	*0.247*
Tibia (n=138)	**8.5 ± 11.7**	**224 ± 235**	**44.0 ± 75.4**
Normal Lactate (<2.5)	6.07 ± 5.64	165 ± 130	35.0 ± 54.8
Intermediate Lactate (2.5-4.0)	7.07 ± 6.73	191 ± 131	29.2 ± 28.3
High Lactate (>4.0)	13.08 ± 18.57	334 ± 358	71.0 ± 116.(
p-value (ANOVA)	*0.009*	*0.001*	*0.021*
Femur (n=208)	**7.7 ± 8.0**	**244 ± 292**	**29.6 ± 36.6**
Normal Lactate (<2.5)	6.46 ± 5.40	194 ± 161	26.3 ± 38.8
Intermediate Lactate (2.5-4.0)	6.92 ± 7.73	223 ± 254	27.8 ± 34.5
High Lactate (>4.0)	9.77 ± 9.49	316 ± 384	34.9 ± 33.2
p-value (high vs normal)	*0.028*	*0.034*	*0.323*

Conclusion: High initial lactate levels are associated with higher hospitalization costs and lengths of stay in orthopaedic trauma patients who underwent fixation for fractures of the lower extremity long bones.