

Student Name: Erin Dolesny (s5175568)

Title: Critically Acclaimed Topic in Trauma

Word Count: 1, 201 words (excluding title page and reference list)

Reference Manager: Endnote

Title: Lactate measurement in the out of hospital setting for trauma is beneficial.

Clinical Scenario

Paramedics are called to a 37-year-old male patient and a 58-year-old female involved in a car accident. On arrival, the male patient was still in the vehicle with a large laceration to their forehead and a visible break to the left femur. The patient presents as hypotensive and tachycardic with cool, clammy skin. The female patient also presents as hypotensive and tachycardic, however, the head-to-toe just revealed a small bump on her forehead. Triaging these patients in order of severity can become difficult.

Lactate formation occurs following a traumatic injury which results in anaerobic glycolysis. Prehospital lactate measurements have the ability to assist in triaging patients and predicting early mortality in trauma patients.

Population-Intervention-Comparison-Outcome (PICO) Question

In prehospital trauma patients, can lactate measurement be used as an indicator for mortality and assist triage processes.

Relevance and Rationale of Question

A small number of ambulance services worldwide currently utilise prehospital lactate measurement devices. Therefore, it is important to explore the PICO question further to evaluate whether ambulance services should be measuring the lactate levels in trauma patients.

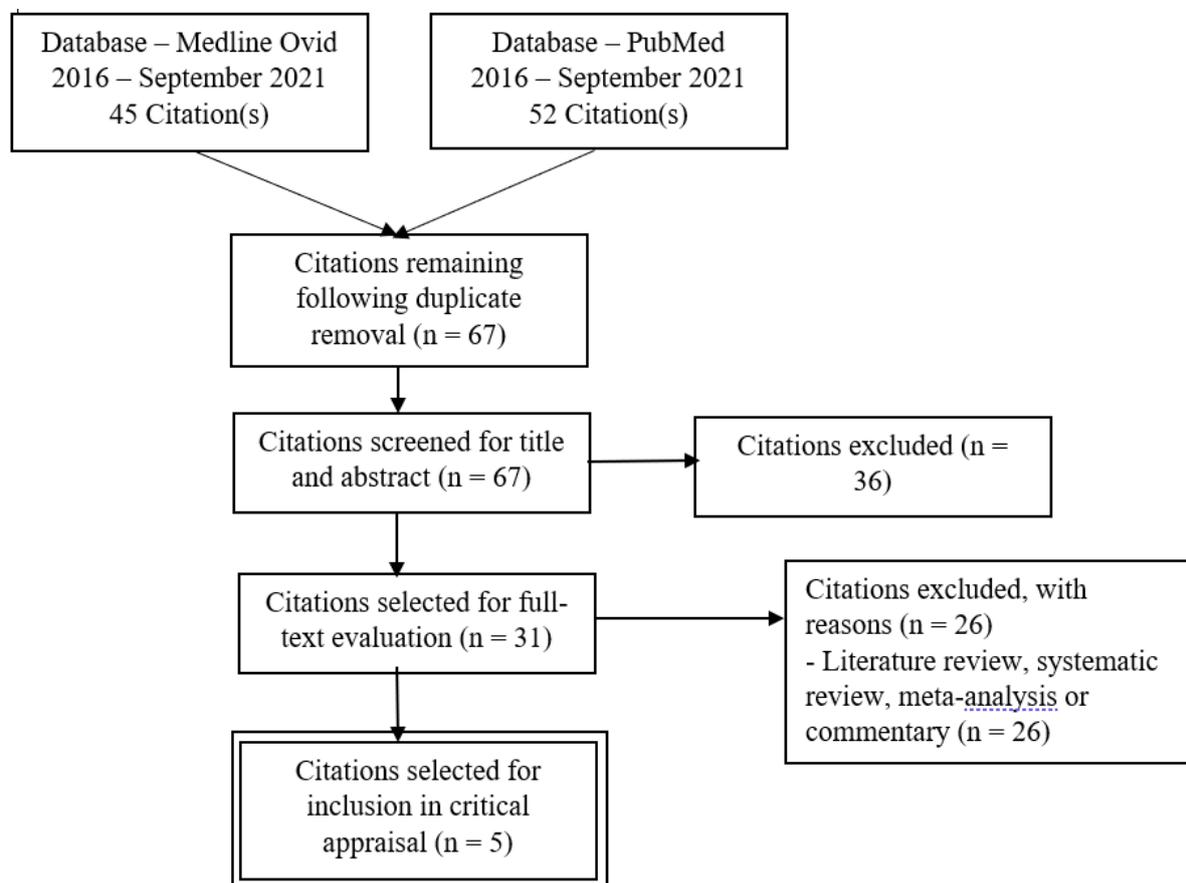
Search Strategy

(pre-hospital OR prehospital OR out-of-hospital OR ambulance OR EMS OR “emergency medical services”) AND (lactate OR “lactate measurement”) AND (trauma or traumatic injuries) AND ((triage) OR (mortality OR death)) in Medline Ovid and PubMed.

Search Outcome

Medline Ovid – 45, PubMed – 52. Total of 67 articles after removal of duplicates.

Relevant papers = 5.



Relevant Papers

Author and Year	Study Design	Population	Results	Strengths and Limitations
Avest et al., 2020	Retrospective cohort study	The study includes trauma patients seen by Air Ambulance, Kent, Surrey & Sussex. Prehospital lactate levels were obtained from 156 trauma patients, with 89.7% of patients being	<ul style="list-style-type: none"> - Injury type directly correlated to elevated lactate levels. Head injuries frequently displayed an increased lactate level. - Patients who were administered IV analgesia displayed lower lactate levels. - Prehospital lactate levels are not only 	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> - Discusses the factors affecting lactate levels in the prehospital setting. <p><u>Limitations:</u></p> <ul style="list-style-type: none"> - Study was conducted on a convenience sample of trauma patients in whom lactate was measured, therefore, results cannot be extrapolated to the wider population of all prehospital trauma patients.

		involved in blunt trauma mechanism.	associated with end organ perfusion and oxygenation.	- Only single lactate measurements were taken which affects the accuracy of the study's results.
Fukuma et al., 2019	Retrospective observational study	435 trauma patients were included in the study. These patients had their blood lactate levels measured both prehospitally and upon arrival to the emergency room.	<ul style="list-style-type: none"> - Patients which had an increase of blood serum lactate levels from the prehospital setting to the ER had a significantly increased probability of immediate intervention required. - Prehospital lactate measurements are cheap and provide effective insight into the severity and urgency of the patients condition. 	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> - Study includes a large sample size. <p><u>Limitations:</u></p> <ul style="list-style-type: none"> - All patients included in the study were from an urban setting with a short transfer time to hospital. This may affect the accuracy of the results as it only includes the one prehospital setting.
Swan et al., 2019	Retrospective clinical audit	253 patients with a median pLA of 2.5mmol/L were analysed. These patients were transported to the Canberra Hospital.	<ul style="list-style-type: none"> - Lactate levels were shown to be non-significantly higher in patients who died compared to survivors. - Elevated prehospital lactate levels were associated with an increased ICU admission rate. 	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> - Study directly shows link between lactate levels and mortality in prehospital setting. <p><u>Limitations:</u></p> <ul style="list-style-type: none"> - Generality is limited as it is based off data from a small ambulance service and a single hospital. - Possible selection bias on the paramedic's behalf. - Interpretation of results may have been limited by the failure to consider medical treatments provided to the patients.
Martin-Rodriguez et al., 2019	Longitudinal prospective, observational study	279 patients were included with the median age being 68 years,	<ul style="list-style-type: none"> - The lactate levels were higher in the group of deceased patients, with a median of 5.3mmol/L. - Higher lactate levels directly corresponded to an increased mortality of patients. 	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> - Showed a direct link between high lactate levels and mortality. <p><u>Limitations:</u></p> <ul style="list-style-type: none"> - Sample size not sufficient to obtain statistically significant results.

			- Concludes that lactate should be used to identify life-threatening conditions which require early attention.	
St. John et al., 2018	Prospective cohort study	The sample size was 314. These were normotensive trauma patients.	<ul style="list-style-type: none"> - Normotensive trauma patients who presented with a prehospital lactate level of 2.5 mmol/L or greater had a 53.4% chance of needing resuscitative cares. - A prehospital lactate level of greater than 3.0mmol/L was shown to produce a 70.9% chance of requiring resuscitation in the immediate future. 	<p><u>Strengths:</u></p> <ul style="list-style-type: none"> - Decent sample size. - Directly addresses the ability of prehospital lactate to predict deterioration. <p><u>Limitations:</u></p> <ul style="list-style-type: none"> - The study included some room for possible bias, which would have skewed the results.

Comments

The purpose of this CAT was to determine the ability of prehospital lactate measurements to provide early indication of mortality and assist in the triage process of trauma patients. The existing research on this topic consisted mainly of retrospective studies and no high-quality randomised control trials. Therefore, the information gathered may not be accurate. From the gathered literature, high levels of lactate in trauma patients are an early indication for clinical deterioration. Patients with high levels of lactate were shown to have a significantly greater chance of requiring resuscitation soon. This information can prove beneficial to the prehospital and in hospital triage systems. The research also indicated that the prehospital treatment, such as analgesia or fluids, provided to trauma patients can have a significant impact on lactate levels. This information is something which should be considered when dealing with trauma patients. The data gathered therefore suggests that prehospital lactate measurements are beneficial.

Consider: *Should current prehospital practice change to implement prehospital lactate measurement?*

As stated above, high quality studies and research surrounding the topic of prehospital lactate measurements is lacking. More accurate information could be obtained from studies such as randomised controlled trials. Nevertheless, the information which was found all suggested a correlation between high lactate levels in the prehospital setting and mortality or resuscitation. Therefore, prehospital lactate measurement can be seen to be beneficial in assisting in triaging and providing paramedics with greater insight into their patient's condition.

Clinical Bottom Line

Lactate measurement in the prehospital setting has been shown to be beneficial in indicating mortality and deterioration of trauma patients. However, few ambulance services worldwide currently use lactate measurement in the prehospital setting. Therefore, as it has been seen to be beneficial, lactate measurement should be globally implemented into ambulance services. Yet, further research is required to fully grasp the extent of how prehospital lactate measurements can benefit paramedics in assessing and triaging trauma patients.

References

- Avest, E., Griggs, J., Wijesuriya, J., Russel, M., & Lyon, R. (2020). Determinants of prehospital lactate in trauma patients: a retrospective cohort study. *BMC Emergency Medicine*, 20(18). <https://doi.org/10.1186/s12873-020-00314-1>
- Fukuma, H., Nakada, T., Shimada, T., Shimazui, T., Aizimu, T., Nakao, S., Watanabe, H., Mizushima, Y. & Matsuoka, T. (2019). Prehospital lactate improves prediction of the need for immediate interventions for haemorrhage after trauma. *Scientific Reports*, 9(13755). <https://doi.org/10.1038/s41598-019-50253-6>
- Martin-Rodriguez, F., Lopez-Izquierdo, R., Villamor, M., Mangas, I., Ibanez, P., Benito, J., Conty, J., Manzanares, J., Mayo-Iscar, A., & Vegas, C. (2019). Prognostic value of lactate in prehospital care as a predictor of early mortality. *The American Journal of Emergency Medicine*, 37(9), 1627-1632. <https://doi.org/10.1016/j.ajem.2018.11.028>
- St. John, A., McCoy, A., Moyes, A., Guyette, F., Bulger, E., & Sayre, M. (2018). Prehospital Lactate Predicts Need for Resuscitative Care in Non-hypotensive Trauma Patients. *West J Emergency Medicine*, 19(2), 224-231. <https://dx.doi.org/10.5811%2Fwestjem.2017.10.34674>
- Swan, K., Avard, B., & Keene, T. (2019). The relationship between elevated prehospital point-of-care lactate measurements, intensive care unit admission, and mortality: A retrospective audit of adult patients. *Australian Critical Care*, 32(2), 100-105. <https://doi.org/10.1016/j.aucc.2018.02.006>