An Evaluation of Point-of-Care Lactate Testing by North East Ambulance Service Enhanced Care Paramedics

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ABSTRACT

Objective. Lactate has been described as a potentially valuable marker for critical illness and mortality in sepsis and trauma patients. This study evaluates the use of point-of-care lactate testing by paramedics in a UK ambulance service.

Methods. Selected Enhanced Care Paramedics were trained to use the lactate meter in patients with suspected sepsis and patients who trigger the major trauma bypass. Feedback was collected on the practicalities of using the meter and the potential impact on the diagnosis of sepsis.

Results. Data was collected on 114 patients, 96% were suspected sepsis (n=109) and 4% (n=5) were for trauma. The paramedics found that lactate readings were useful and supported and increased their confidence in their clinical decision making.

Conclusions. Point-of-care lactate measurement is feasible in pre-hospital care and appears to support paramedics in their decision making.

BACKGROUND

North East Ambulance Service NHS Foundation Trust (NEAS) covers the north east of England and employs around 1,000 accident and emergency staff across 57 locations who serve a population of 2.6 million people.

As part of the NEAS drive to improve patient care, a screening tool (SST) was introduced into practice in April 2012. One of the criteria for severe sepsis on the SST is a lactate of ≥2mmol/L, which NEAS paramedics have previously been unable to measure. The potential use of lactate in pre-hospital care has been reported elsewhere by the authors (McClelland, Younger and Byers, 2012) and provided some of the background for this study.

There have been a number of recent studies examining the use of point-of-care (POC) lactate testing in pre-hospital sepsis care. Sokolow et al (2013) undertook a pilot study of paramedic use of portable arterial blood gas machines and concluded that lactate may be predictive of mortality with this technology and be useful for further work. Johannsen et al (2008) compared lactate with other traditional pre-hospital observations in patients who had capillary and venous blood pressure and heart rate. Lactate measurement also provided improved information regarding mortality.

Guerra et al. (2013) conducted a small study investigating Emergency Medical Service (EMS) use of a sepsis alert protocol and the use of POC venous lactate meters. In this study EMS staff failed to identify 52% of the patients who were ultimately diagnosed with severe sepsis on arrival at the ED. They concluded that the widespread use of lactate meters could significantly improve the pre-hospital screening tool that was used.

Whereas the studies described above focused on sepsis as a condition where POC lactate may have value, other studies have considered the applicability of POC lactate to a wider population. Mullen et al. (2014) looked at non-trauma patients transported by a US aeromedical service and concluded that lactate may correlate with mortality but again called for further work. Jansen et al. (2008) compared lactate with other traditional pre-hospital observations in patients who had capillary and venous blood pressure and heart rate. Lactate measurement also provided improved information regarding mortality.

Overall the literature shows that lactate has the potential to aid in identifying and stratifying of critically ill patients, including those with severe sepsis. It has been recognised that there is a gap in the evidence around the use of POC lactate testing within UK ambulance services.

OBJECTIVES

• To evaluate the Nova StatStrip Lactate Xpress for POC lactate measurement in the pre-hospital environment.
• To investigate what impact adding POC lactate would have on the Sepsis Screening Tool (SST)
• To assess what effect lactate measurement would have on the end dispositions of patients.

METHODS

Participants only used the lactate meter when blood was already being taken for the purpose of measuring the patient’s blood glucose or through the process of IV cannulation so no additional invasive procedure was needed.

The target sample was 200 patients over six months, this target was set based on an estimation of ECare paramedic workload and previous research that the authors had undertaken on sepsis screening (McClelland & Younger 2013). During the evaluation it was found that the target of 200 was overly ambitious, therefore a decision was made to extend the evaluation period for a further three months with a reduced target of 100 patients.

At the end of the evaluation the participants were asked to complete an overall evaluation of the device and asked for feedback on how they felt the device added in pre-hospital use and whether it had any effect on their practice. In order to allow for purposeful analysis of the data a series of questions were asked with the responses being recorded on a five point Likert scale.

RESULTS

114 patients (58% female, mean age 70, range 6-100) had lactate levels recorded

• 109 patients for suspected sepsis (61% female, mean age 71, range 6-100)
• 5 trauma patients (100% male, mean age 51, range 10-74)

Lactate values ranged from 0.7-11.2mmol/L with a mean of 2.6mmol/L

53% (n=58) of the sepsis patients met the criteria for severe sepsis according to the SST.

60% (n=35) of the severe sepsis patients met the criteria on lactate alone.

Samples sources:

• 66.7% (n=76) taken from capillary samples
• 29.8% (n=34) taken from venous sampling
• 3.5% (n=4) having both capillary and venous samples taken

Figure 2. ‘Do you feel that the use of this machine would assist you in your clinical decision to decide to treat or not to treat this patient for sepsis?’

FIGURE 1. LACTATE LEVELS FOR NEAS EVALUATION OF THE STATSTRIP LACTATE XPRESS

DISCUSSION

This study addresses our primary objective which was to evaluate the Nova StatStrip Lactate Xpress for POC lactate measurement in the pre-hospital environment and we have shown that the device is usable in the pre-hospital environment and appears to aid paramedics in confidently identifying severe sepsis as shown in figure 2.

The population encountered, and the range of lactate values recorded, are in accordance with figures reported in the current literature. The low number of trauma cases was not unexpected and is a population that needs to be studied separately. All the participants felt confident using the device with the majority reporting that lactate would influence their decision in patient treatment and that patients would benefit from paramedics having this capability. The results in figure 3 are encouraging as they show that in 50% of cases paramedics believe the use of POC lactate had an effect on the treatment delivered.

The large number of patients who presented with lactate as the only sign of organ dysfunction on the SST, raises concerns that without lactate patients are at risk of treatment being delayed. Erinw et al. (2011) described that paramedics were able to detect sepsis but were not able to differentiate between sepsis and severe sepsis so the addition of POC lactate helps to address this issue. The ability to differentiate between sepsis and severe sepsis could help prevent inappropriate hospital admissions, as sepsis can, where appropriate, be managed by primary care in the community. The ability to accurately identify severe sepsis which is the only stage with mandated treatment in the SST, is important as these patients have a high mortality and early identification has been shown to lead to early treatment and improvements in patient outcomes (Girou et al., 2013).

Although there were only a small number of patients who had both capillary and venous samples taken, there is a suggestion that the values may differ depending on the source of the sample. In cases where both a capillary and venous sample were taken the capillary sample was higher in all cases. This is in contrast to Bakker, Nijsten and Jansen (2013) and Brown et al. (2014) who claim that the sample site does not overly affect the result. We recommend that the site for taking lactate samples be standardised in future protocols and further work could be undertaken to ascertain if lactate based triggers in sepsis screening tools should vary depending on the source of the sample. The difference in lactate measurement between the source sites could lead to patients triggering, or not triggering, a treatment pathway, and therefore further work is required into this variance.

There are a number of limitations to this project. The study did not assess the effect of lactate measurement on patient outcome, therefore, the potential for end diagnosis, as the effect of initiating lactate measurement had on the sensitivity and specificity of the SST. The small number of staff exposed to the device, the lack of follow up to compare pre-hospital measurements with in-hospital measurement and the lack of patient outcome data to judge the impact of POC lactate are all acknowledged as weaknesses in this study.

Further work is needed to examine the impact of adding lactate to the paramedic toolbox and its place in the SST. Further work could explore the accuracy of the sepsis screening tools used by paramedics and what impact the addition, or omission, of lactate measurement would have on the patient pathway, treatments, quality of life, and survival to discharge. There is also scope for exploring the use of lactate in trauma through targeted hospital environs, with a higher exposure to trauma cases such as the Hazardous Area Response Teams (HART) in order to examine any impact in these populations.

Concerns were identified with staff conducting quality control checks around POC in the pre-hospital environment which requires further work. The paramedics felt confident using the device with most reporting that lactate would influence their decision in patient treatment and that patients would benefit from paramedics having this capability. The results in figure 3 are encouraging as they show that in 50% of cases paramedics believe the use of POC lactate had an effect on the treatment delivered.

CONCLUSIONS

POC lactate testing in the pre-hospital environment has been shown to be feasible. POC lactate measurement may benefit patients by helping identify cases of severe sepsis which then allows paramedics to start the appropriate treatment.

REFERENCES


