Nemaura Medical

Better Diagnostics for Life

NASDAQ: NMRD

BEAT™ Continuous non-invasive Lactate Monitoring In Critical Care and Monitoring Disease Progression in Covid-19

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Overview

Continuous Lactate monitoring has Potential in Medical and non Medical Applications.

Medical Field

– Recent reports of elevated Lactate levels in Covid-19 patients

– Critical Care monitoring

Non-Medical Field

– Athletic performance monitoring/endurance training

This presentation highlights the potential applications of Continuous Lactate Monitoring in Critical Care, and monitoring disease progression in Covid-19 patients

Nemaura's CLM (Continuous Lactate Monitoring) device is based on the BEAT™ platform used in sugarBEAT®, with appropriate adaptations to the sensor chemistry, the algorithm and the mobile app interface. Nemaura is evaluating the timelines for bringing this product to market as a Class 2 approved medical device.

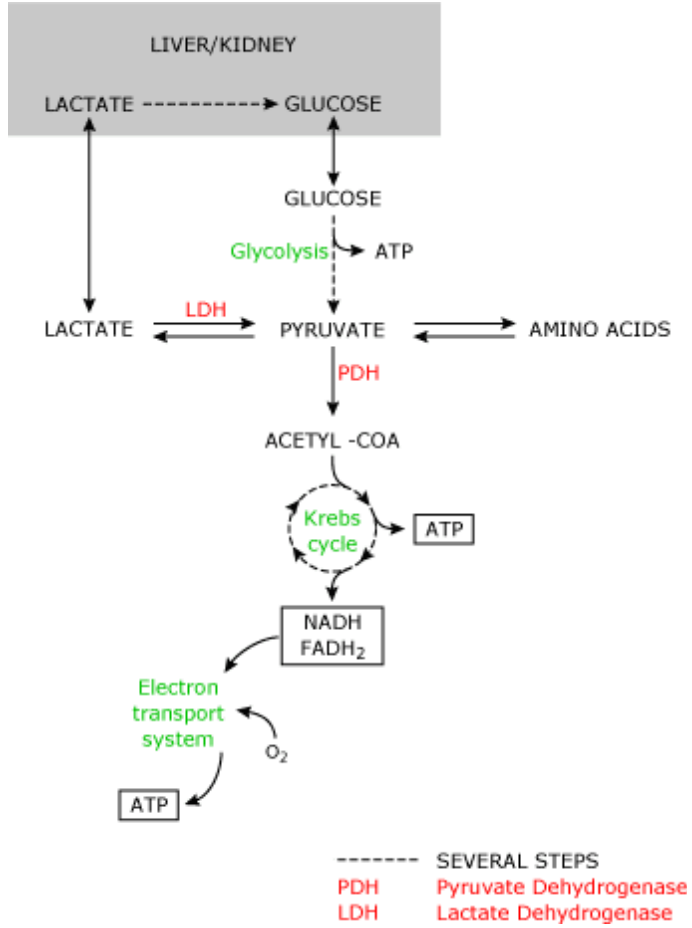
Increased blood lactate levels: a marker of critical disease states

Normal blood lactate levels are 1.3 mmol/L. Lactate metabolism mainly occurs in the liver and kidney.

Increased lactate levels have been consistently associated with morbidity and mortality in a wide range of disease states for many years.

Increased blood lactate levels, in combination with acidosis, should urge the clinician to restore a probable imbalance between oxygen demand.

Increased blood lactate levels should prompt the clinician to initiate both diagnostic and immediate therapeutic actions and intensive care admission should be considered.



https://acutecaretesting.org/en/articles/increased-blood-lactate-levels-a-marker-of

Clinical use of lactate monitoring in critically ill patients

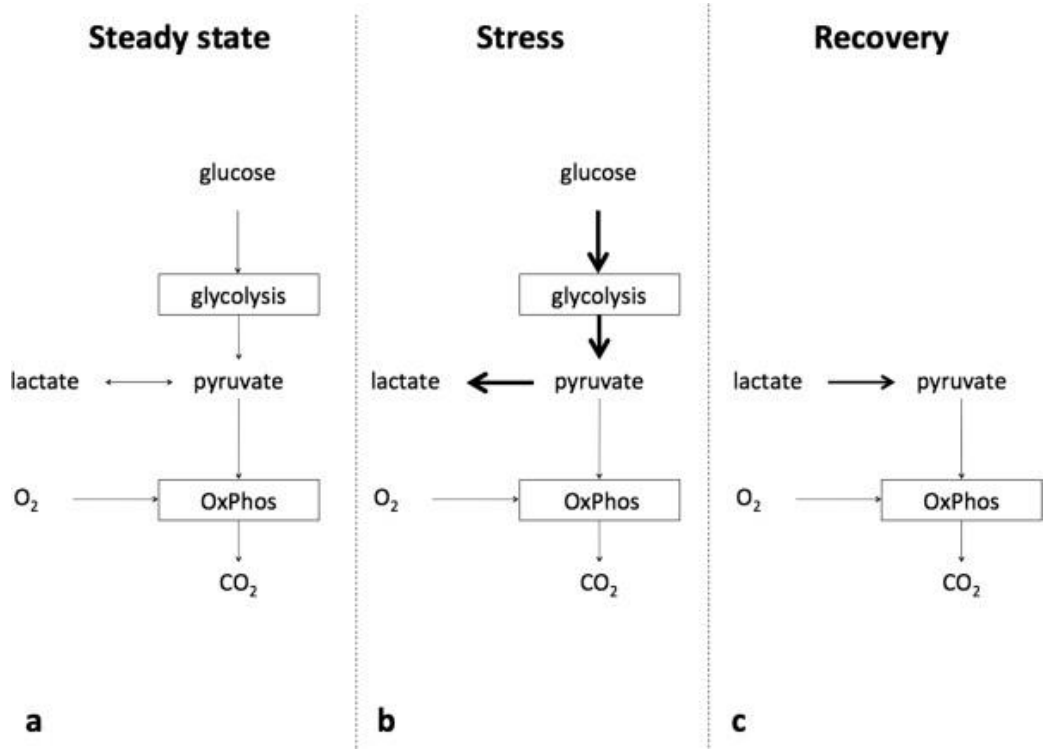
Increased blood lactate levels (hyperlactataemia) is common in critically ill patients.

Lactate levels are frequently used to diagnose inadequate tissue oxygenation, and other processes not related to tissue oxygenation may also increase lactate levels.

Increased lactate levels usually reflect increased morbidity and high mortality.

Two multicenter trials suggest that the use of lactate levels in goal-directed therapy may improve clinical outcome.

Findings confirm that lactate monitoring is a valuable parameter in the early resuscitation of critically ill patients.



https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3654944/

Clinical applications of lactate testing in patients with sepsis and septic shock

Hyperlactatemia is very common in patients with sepsis and septic shock and is closely associated with poor prognosis.

The third international consensus definition for sepsis and septic shock recently revised the definition of septic shock.

Serum lactate concentration >2 mmol/L was added as a key component in the definition of septic shock.

The Surviving Sepsis Campaign (SSC)recommended lactate normalization in patients with elevated lactate levels as a marker of tissue hypoperfusion

http://jeccm.amegroups.com/article/view/4083/4694

Covid-19: A retrospective review of medical records in a single medical centre, Wuhan, China

Analysis of laboratory test results of dead patients

LABORATORY FINDINGS	TEST RESULTS (MEDIAN, IQR)	NORMAL RANGE	TOTAL (*N*)	BELOW THE LOWER (*N*, %)	ABOVE THE UPPER (*N*, %)
Alanine transaminase (U/L)	24 (16.5–46)	9–50	25	1 (4)	4 (16)
Aspartate aminotransferase (U/L)	37 (29.5–57.5)	15–40	25	0 (0)	9 (36)
Albumin (g/L)	32.81 (28.56–36.04)	40–55	25	25 (100)	0 (0)
Blood urea nitrogen (mmol/L)	9.29 (6.07–16.4)	3.6–9.5	23	2 (8.7)	10 (43.5)
Creatinine (μmol/L)	66 (49.5–161)	57–111	24	9 (37.5)	8 (33.3)
Hypersensitive troponin I (ng/mL)	316 (57–5420)	0–40	15	0 (0)	11 (73.3)
Amino-terminal pro-brain natriuretic peptide (pg/mL)	2450 (881–7992)	<75y: 0–125 / >75y: 0–450	17	0 (0)	16 (94.1)
White blood cells ($\times 10^9$, cells/L)	11.01 (7.51–15.39)	3.5–9.5	25	3 (12)	17 (68)
Neutrophils ($\times 10^9$, cells/L)	10.41 (6.44–14.4)	1.8–6.3	25	0 (0)	18 (72)
Lymphocytes ($\times 10^9$, cells/L)	0.52 (0.27–0.71)	1.1–3.2	25	22 (88)	0 (0)
Red blood cells ($\times 10^{12}$, cells/L)	3.82 (3.07–4.13)	4.3–5.8	25	20 (80)	0 (0)
Haemoglobin (g/L)	121 (96–135.5)	130–175	25	17 (68)	0 (0)
Platelets ($\times 10^9$, cells/L)	150 (123–212)	125–350	25	7 (28)	0 (0)
Procalcitonin (ng/mL)	0.36 (0.13–1.91)	0–0.1	21	0 (0)	19 (90.5)
C-reactive protein (mg/L)	91.1 (55.55–146.3)	0–10	20	0 (0)	19 (95)
Serum amyloid A (mg/L)	300 (300–300)	0–10	21	0 (0)	21 (100)
Lactate (mmol/L)	3.35 (1.96–5.1)	0.5–1.5	16	0 (0)	16 (100)
SARS-CoV-2 virus	Positive	Negative	25	0 (0)	25 (100)

Below the Lower: Below the lower limit of normal range; Above the Upper: Above the upper limit of normal range.

https://www.sciencedirect.com/science/article/pii/S1201971220301867

Covid-19: A retrospective review of medical records in a single medical centre, Wuhan, China

Specific biomarker that indicating poor prognosis

LABORATORY FINDINGS	THE FIRST TEST (MEDIAN, IQR)	THE LAST TEST (MEDIAN, IQR)	TOTAL (N)	INCREASED (N, %)	DECREASED (N, %)
Neutrophils ($\times 10^9$, cells/L)	6.01 (3.09–8.90)	10.36 (2–17.31)	16	14 (87.5)	2 (12.5)
Lymphocytes ($\times 10^9$, cells/L)	0.62 (0.33–0.92)	0.40 (0.13–1.1)	16	12.5 (12.5)	14 (87.5)
Procalcitonin (ng/mL)	0.11 (0.07–0.24)	1.12 (0.14–1.98)	11	11 (100)	0 (0)
C-reactive protein (mg/L)	52.9 (19.55–79.8)	96.2 (53.35–161.1)	13	11 (84.6)	2 (15.4)
Serum amyloid A (mg/L)	300 (99.39–300)	300 (300–300)	12	5 (41.7)	1 (8.3)
Hypersensitive troponin I (pg/mL)	75 (37.5–258.5)	293 (167.5–1023)	9	7 (77.8)	1 (11.11)
D-dimer (mg/L)	1.18 (0.42–4.04)	9.93 (2.65–54.8)	12	9 (75)	3 (25)
Lactic dehydrogenase (U/L)	321 (250–372)	510 (364–617.5)	9	9 (100)	0 (0)
Lactate (mmol/L)	1.35 (0.68–1.5)	2.75 (1.83–3.55)	12	12 (100)	0 (0)

Increased, Decreased: Results of the last test vs. Results of the first test.

https://www.sciencedirect.com/science/article/pii/S1201971220301867

Lymphopenia predicts disease severity of COVID-19: a descriptive and predictive study

Analysis of possible reasons for lymphopenia in COVID-19 patients

- Hyperlactic acidemia/ lactic acidosis inhibit lymphocytes
- The severe type of COVID-19 patients had elevated blood lactic acid levels, which suppress the proliferation of lymphocytes.

https://www.nature.com/articles/s41392-020-0148-4?fbclid=IwAR0oNmxwN2RaKh4N7xSNizHOJCBwTfWwRoZLV942Hq9OreoT0-E4wmrtFC8

Epidemiologic and clinical characteristics of 91 hospitalized patients with COVID-19 in Zhejiang, China: a retrospective, multi-centre case series

Laboratory findings of COVID-19 patients on admission to hospital

LABORATORY FINDINGS	PATIENTS (N = 91)
Cl− (mmol/l; 99–110)	103 (100.55–105)
Increased / Decreased	1 (1.10) / 8 (8.79)
Ca2+ (2.11–2.52)	2.16 (2.06–2.25)
Increased / Decreased	1 (1.10) / 11 (12.09)
Aterial blood gas	
PaO_2 (mmHg; 83–108)	75.6 (53.5–90.38)
Increased / Decreased	6 (17.65) / 18 (52.94)
$PaCO_2$ (mmHg; 35–48)	36.5 (28–41)
Increased / Decreased	1 (2.94) / 2 (5.88)
Lactic acid (mmol/l; <1.6)	1.4 (1.1–1.93)
Increased / Decreased	19 (55.88) / 0
PH (7.35–7.45)	7.44 (7.40–7.46)
Increased / Decreased	10 (29.41) / 0
Infection-related biomarkers	
C-reactive protein (mg/l; 0–5)	6.81 (1.87–15.30)
Increased / Decreased	49 (53.85) / 0
Procalcitonin (ng/ml; <0.04)	0.02 (0–0.04)
Increased / Decreased	14 (15.39) / 0

Values are expressed as medians (interquartile ranges) or n (%), where N is the number of patients. COVID-19 = 2019 novel coronavirus diseases. Data of Arterial Blood Gas were available in 34 cases.

https://academic.oup.com/qjmed/article/113/7/474/5809152

Conclusions

Increase in blood lactate levels is a marker of critical disease states.

Recent publications have indicated the presence of elevated lactate levels in patients with Covid-19 infection.

Continuous Lactate Monitoring therefore has applications in disease states including the monitoring of disease progression in Covid-19 infections.