Love, hate what do I do with this lactate…?

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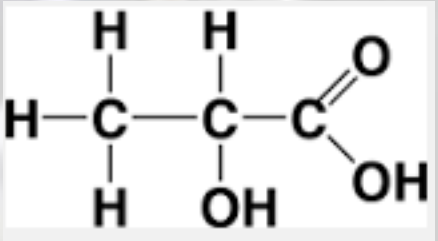
Talk about today

- Lactate background
- Physiology – it's not all ischaemia
- Association b/w high lactate and mortality
- Association b/w lactate decrease and improved survival
- Beta blockers and lactate
- What makes lactate go up and down

What is lactate

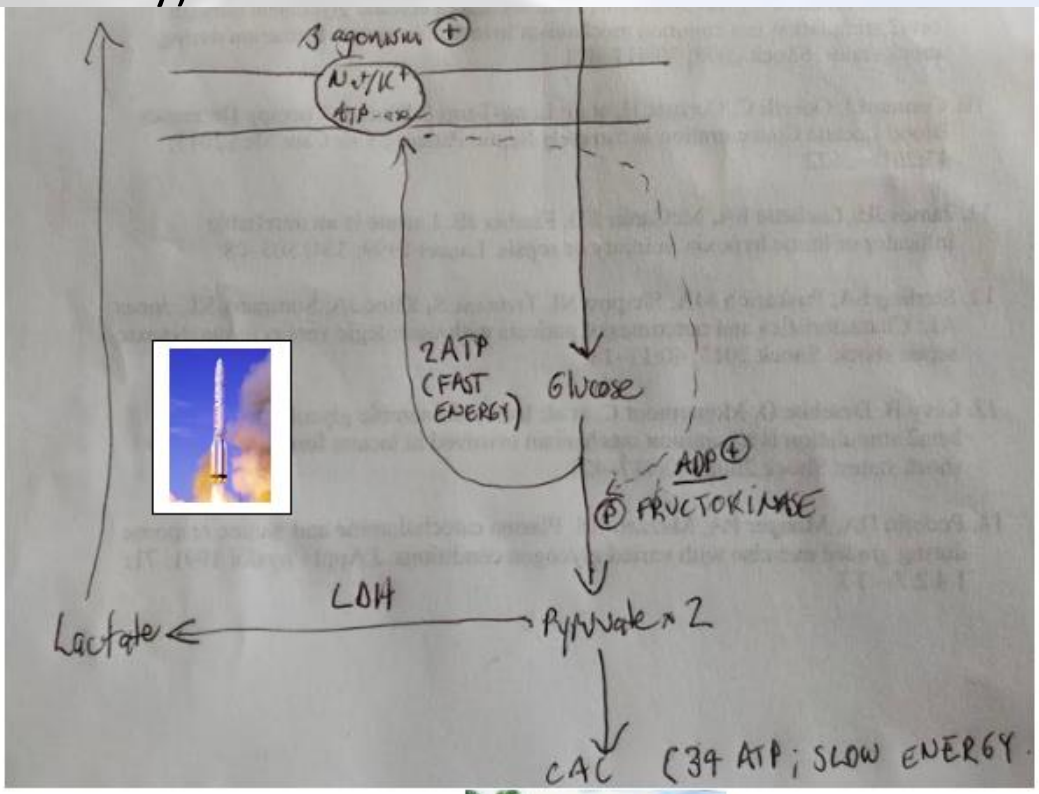
- In medicine, lactic acid is a product of incomplete glucose metabolism.



- Lactate is the strongly dissociative cation of lactic acid

Lactate production

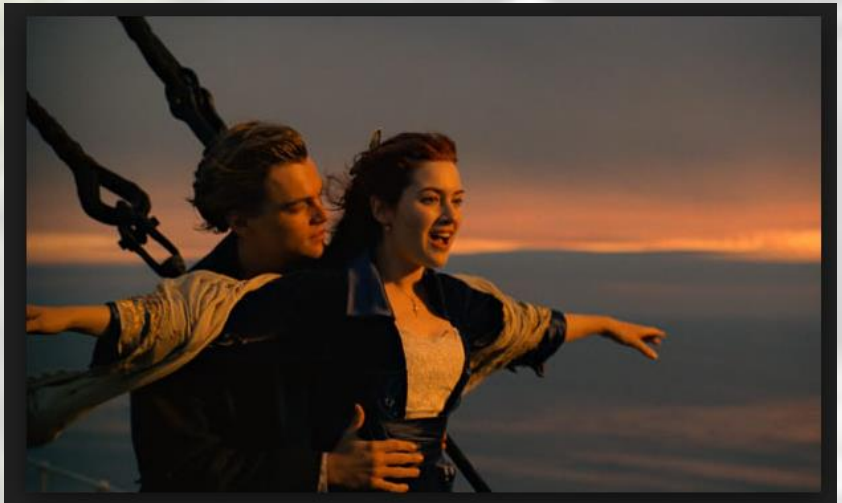
- Lactate is the product of *incomplete* glucose metabolism (glycolysis)
  - Glycolysis can be anaerobic (necessity) *or aerobic*
  - Glycolysis provides fast ATP



And lactate shuttle goes on… and on….

- Biologically available potential energy is left in the remaining molecule
- A gift from one tissue bed to another
- Used as energy source/

gluconeogenesis by liver/kidney/heart/brain



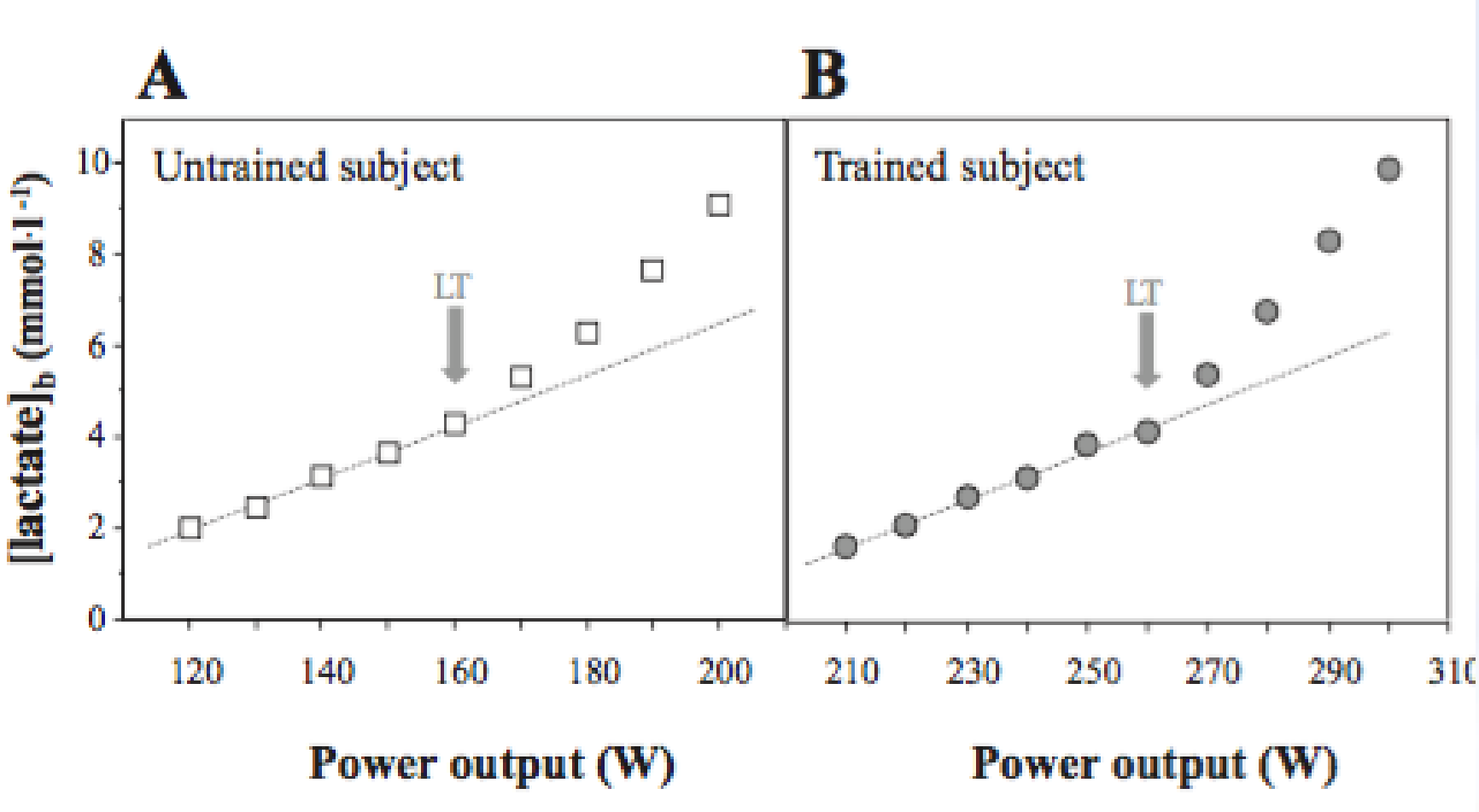
Glycolysis is a high power energy source

System	Power (rate of ATP production)	Capacity (total ability to produce ATP)	Fuels Used
phosphagen system	very high	very low	creatine phosphate stored ATP
glycolysis	high	low	blood glucose muscle & liver glycogen
aerobic system	low	very high	blood glucose muscle & liver glycogen adipose & intramuscular fa

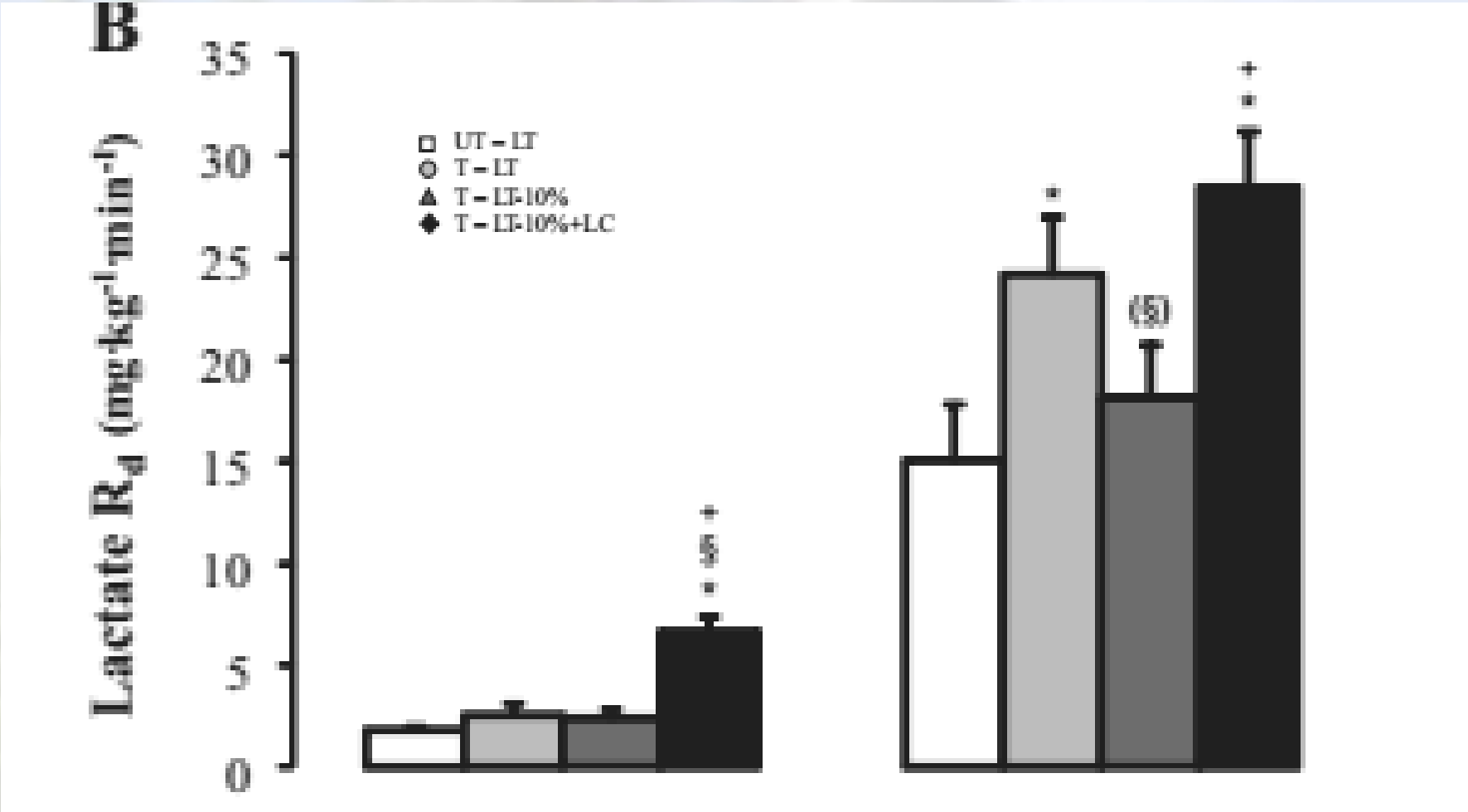
Adrenaline vs ischaemia

- A false dichotomy?
- Or, at very least, a dichotomy of limited conceptual value….
- So long as we realise *not all hyperlactaemia is fixed by increased oxygen delivery nor due to tissue hypoxia*

The shuttle breaks down…



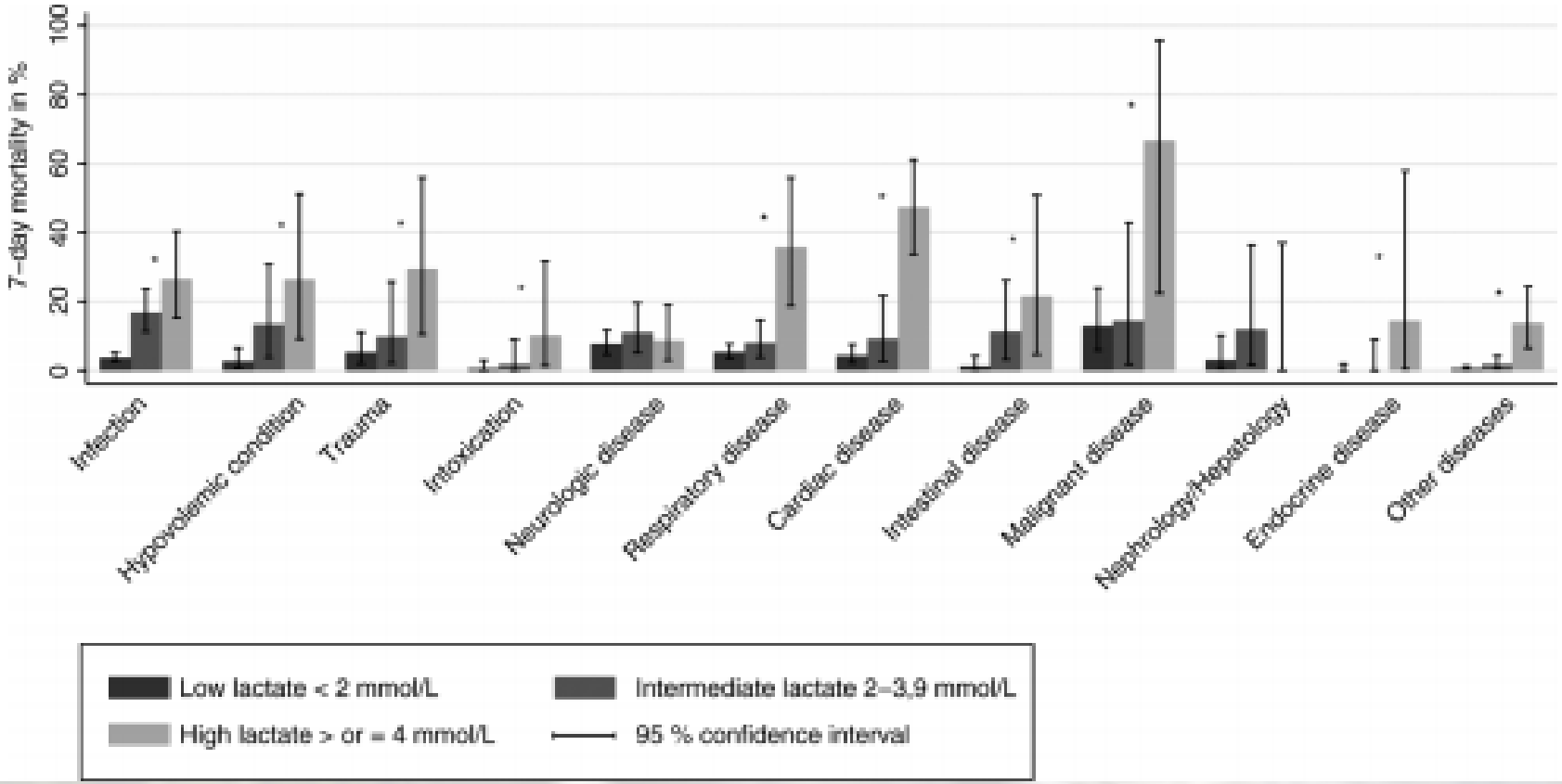
Lactate clamp



Lactate level, aetiology and mortality of adult patients in an emergency department: a cohort study

Mathilde Pedersen, Vibeke Schnack Brandt, Jon Gitz Holler, Annmarie Touborg Lassen

Pedersen M, *et al. Emerg Med J* 2015;**32**:678–684.



Lactate clearance

- ANDROMEDA SHOCK JAMA 2019

Key Points

Question Does the use of a resuscitation strategy targeting normalization of capillary refill time, compared with a strategy targeting serum lactate levels, reduce mortality among patients with septic shock?

Findings In this randomized clinical trial of 424 patients with early septic shock, 28-day mortality was 34.9% in the peripheral perfusion–targeted resuscitation group compared with 43.4% in the lactate level–targeted resuscitation group, a difference that did not reach statistical significance.

Meaning These findings do not support the use of a peripheral perfusion–targeted resuscitation strategy in patients with septic shock.

Early lactate clearance is associated with improved outcome in severe sepsis and septic shock*

H. Bryant Nguyen, MD, MS; Emanuel P. Rivers, MD, MPH; Bernhard P. Knoblich, MD; Gordon Jacobsen, MS; Alexandria Muzzin, BS; Julie A. Ressler, BS; Michael C. Tomlanovich, MD

Crit Care Med 2004 Vol. 32, No. 8

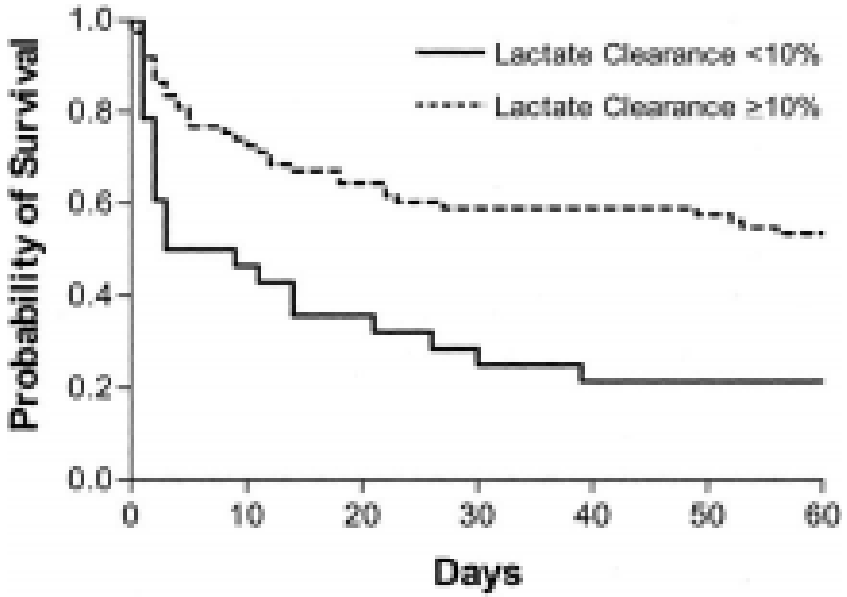


Figure 1. Kaplan-Meier survival analysis between patients with lactate clearance <10 vs. ≥10% at 6 hrs after emergency department presentation.

Lactate clearance as a predictor of mortality in trauma patients

Stephen R. Odom, MD, Michael D. Howell, MD, MPH, George S. Silva, BA, Victoria M. Nielsen, Alok Gupta, MD, Nathan I. Shapiro, MD, MPH, *and* **Daniel Talmor, MD, MPH,** *Boston, Massachusetts*

J Trauma Acute Care Surg
Volume 74, Number 4

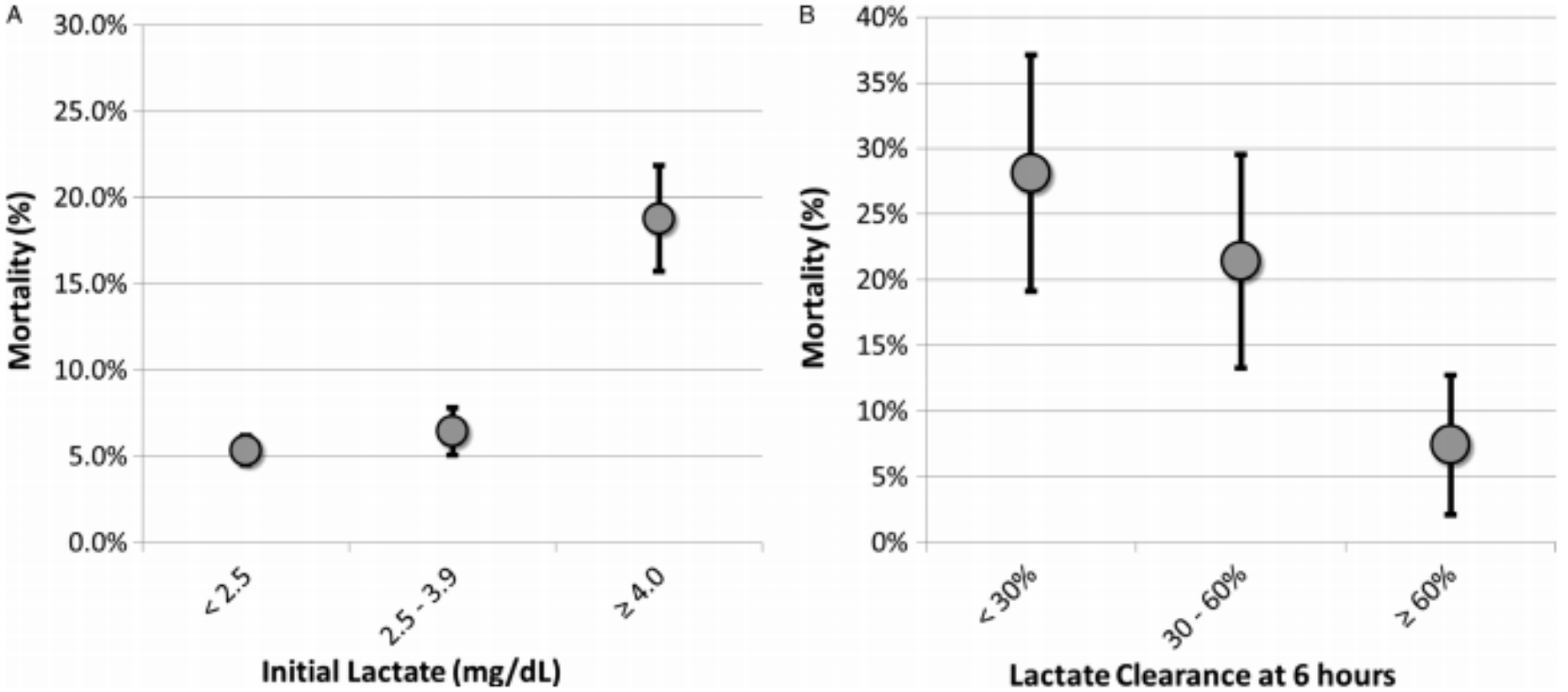
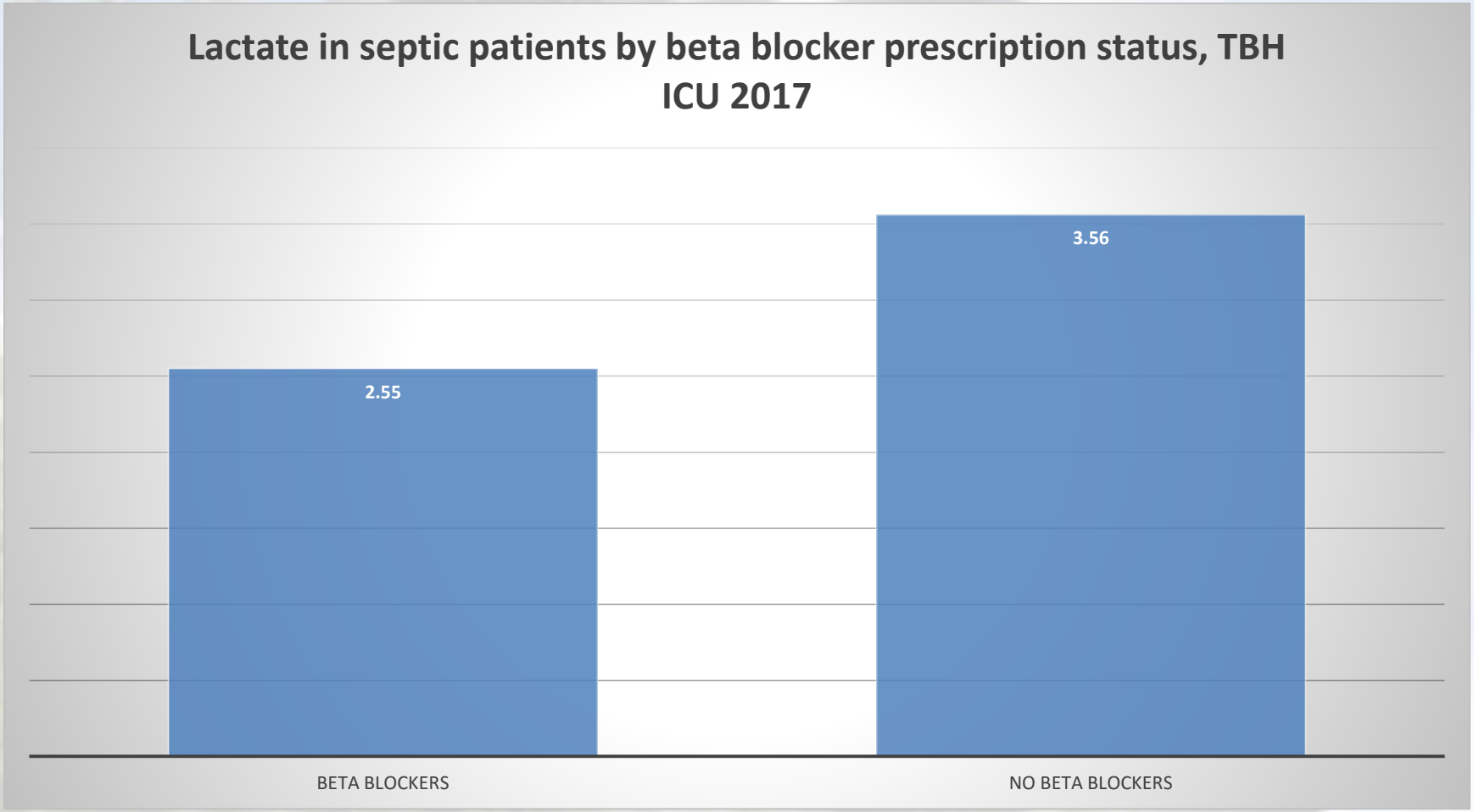


Figure 1. (A) Unadjusted relationship between initial lactate level and mortality. Mortality increases with increasing lactate. (B) Lactate clearance at 6 hours, among patients with initially elevated lactate. Mortality is highest in patients that do not clear lactate in 6 hours.

Beta blockers and lactate



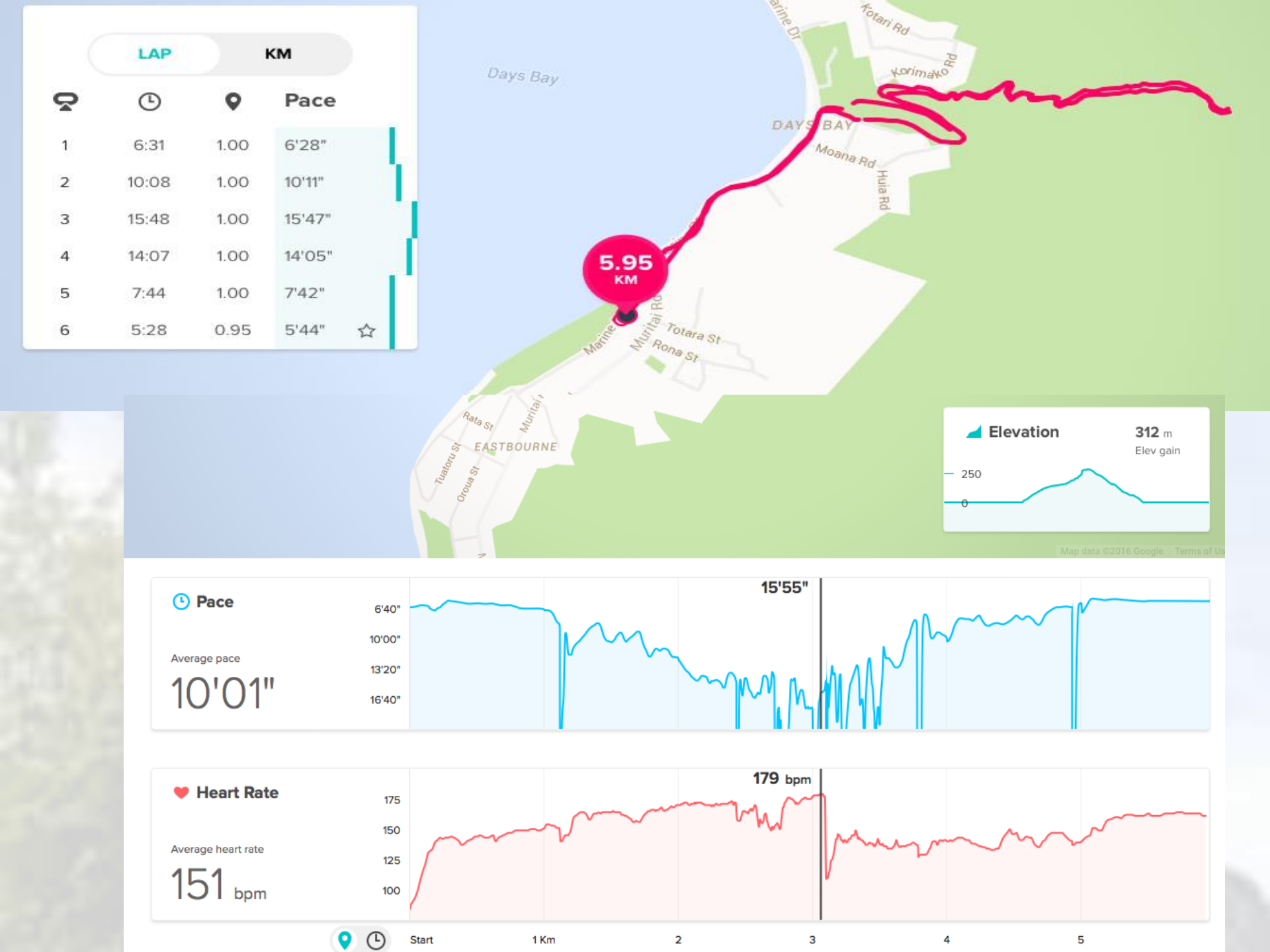
Causes hyperlactaemia

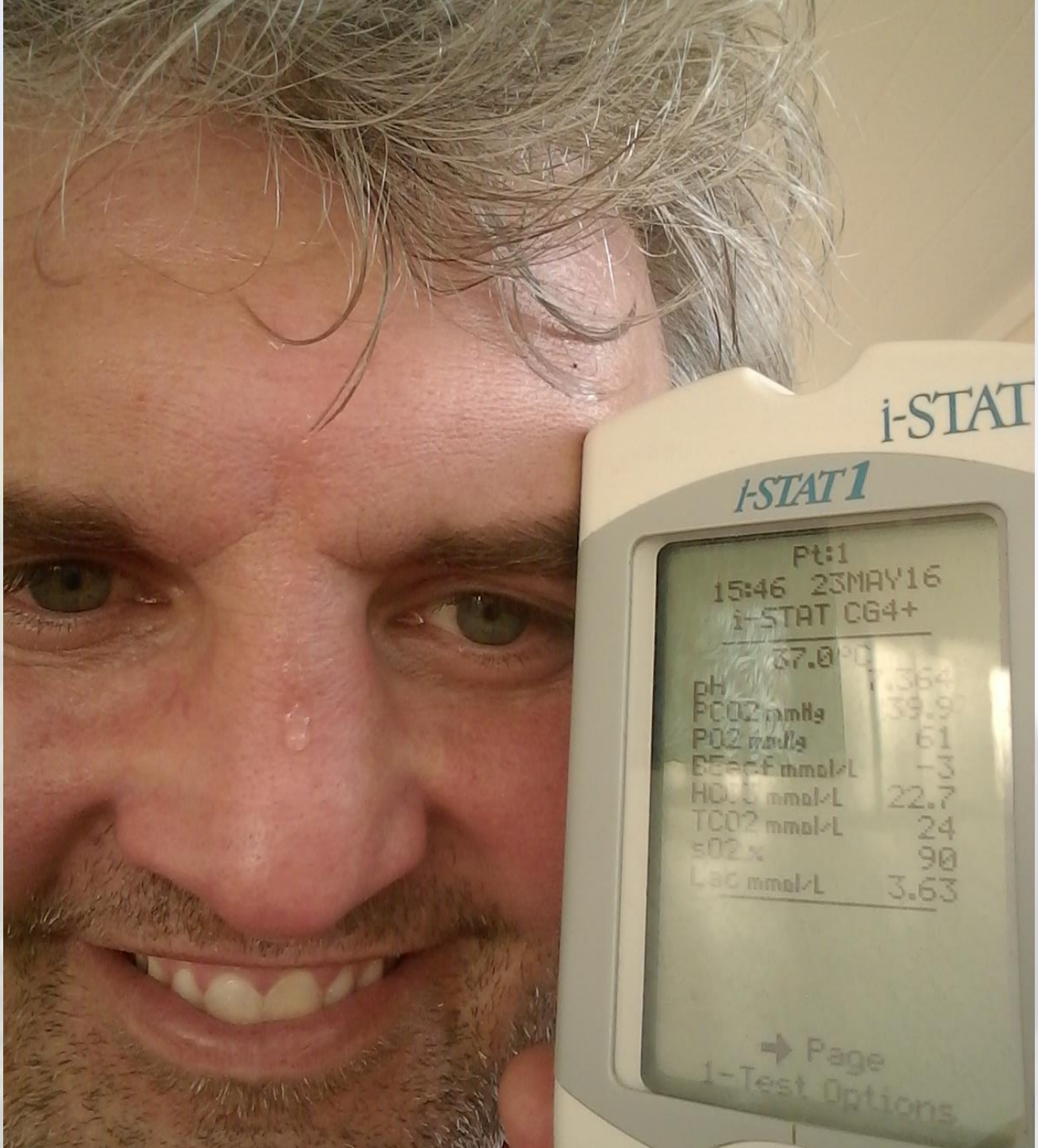
- Aerobic glycolysis
  - Cytokines
  - Beta agonists (endogenous and exogenous)
- Reduction in oxygen delivery
  - Global or local
  - CO, dec carriage (anaemia, hypoxia), wasted circulation
- Drugs
  - Salicylates, metformin
- Hepatic failure
- Malignancy (particularly haematologic)

You can use lactate…

37.0°C	
pH	7.246
PCO2 mmHg	34.5
PO2 mmHg	87
BEecf mmol/L	−12
HCO3 mmol/L	15.0
tCO2 mmol/L	16
sO2%	95
Lac mmol/L	13.26


i-STAT
i-STAT 1
37.0°C
7.254
HCO3 mmol/L 13.8
TCO2 mmol/L 15
Page
1-Test Options


LAP
KM
Pace
1 6:31 1.00 6'28"
2 10:08 1.00 10'11"
3 15:48 1.00 15'47"
4 14:07 1.00 14'05"
5 7:44 1.00 7'42"
6 5:28 0.95 5'44"
Days Bay
DAYS BAY
EASTBOURNE
Kotari Rd
Korimako Rd
Moana Rd
Hula Rd
Marine Dr
Muritai Rd
Totara St
Rona St
Rata St
Tuatoru St
Oroua St
5.95 KM
Elevation
312 m
Elev gain
250
0
Map data ©2016 Google
Pace
Average pace
10'01"
6'40"
10'00"
13'20"
16'40"
15'55"
Heart Rate
Average heart rate
151 bpm
175
150
125
100
179 bpm
Start
1 Km
2
3
4
5


i-STAT
i-STAT 1
Pt:1
15:46 23MAY16
i-STAT CG4+
37.0
pH 7.364
PCO2 mmHg 39.9
PO2 mmHg 61
BEecf mmol/L -3
HCO3 mmol/L 22.7
TCO2 mmol/L 24
sO2 % 90
Lac mmol/L 3.63
Page
1-Test Options

Love, hate what do I do with this lactate?

- Rather than looking at a particular lactate level and thinking “good” vs “bad” think:
- WHY???
- If this is bad what actual or potential reversibles are there to fix?
- How hard is this patient having to work to stay alive at the metabolic level?