PULSION Medical Systems

EIRUS Technology Literature

Contents

1. EIRUS: validation of the accuracy of the technology .......................................................... 2
   1.1. Glucose ........................................................................................................................ 2
   1.2. Lactate ......................................................................................................................... 2
2. Glucose ................................................................................................................................ 3
   2.1. Need for Glucose Control ............................................................................................ 3
   2.2. Debate on Tight Glucose Control ................................................................................ 3
   2.3. Health Economic Aspects of Glucose Monitoring ....................................................... 4
   2.4. Glucose Monitoring - Examples of Fields of Application ............................................. 4
       2.4.1. Neurology ................................................................................................................. 4
       2.4.2. Burns ........................................................................................................................ 5
3. LACTATE .............................................................................................................................. 6
   3.1. Need for Lactate Monitoring ....................................................................................... 6
   3.2. Lactate Monitoring - Examples of Fields of Application .............................................. 7
       3.2.1. Sepsis ........................................................................................................................ 7
       3.2.2. Burns ........................................................................................................................ 7
       3.2.3. Liver Surgery ............................................................................................................ 7

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1. **EIRUS: validation of the accuracy of the technology**

1.1. **Glucose**

Schierenbeck F, Wallin M, Franco-Cereceda A, Liska J
*Evaluation of Intravascular Microdialysis for Continuous Blood Glucose Monitoring in Hypoglycemia: An Animal Model*

Schierenbeck F, Owall A, Franco-Cereceda A, Liska J
*Evaluation of a continuous blood glucose monitoring system using a central venous catheter with an integrated microdialysis function.*

Schierenbeck F, Franco-Cereceda A,
*Evaluation of a continuous blood glucose monitoring system using central venous microdialysis*
J Diabetes Sci Technol 2012; 6(6): 1365-1371

Moller F, Liska J, Eidhagen F, Franco-Cereceda A
*Intravascular microdialysis as a method for measuring glucose and lactate during and after cardiac surgery.*

1.2. **Lactate**

Schierenbeck F, Nijsten MW, Franco-Cereceda A, Liska J
*Introducing intravascular microdialysis for continuous lactate monitoring in patients undergoing cardiac surgery: a prospective observational study*
Crit Care 2014; 18(2): R56
2. Glucose

2.1. Need for Glucose Control

Krinsley JS
Understanding glycemic control in the critically ill: three domains are better than one
Intensive Care Med 2011; 37(3): 382-384

Hypoglycemia and outcome in critically ill patients

Garrouste-Orgeas M, Timsit JF, Vesin A, Schwebel C, Arnodo P, Lefrant JY, Souweine B, Tabah A,
Charpentier J, Gontier O, Fieux F, Mourvillier B, Troche G, Reignier J,
Dumay MF, Azoulay E, Reignier B, Carlet J, Soufir L
Selected medical errors in the intensive care unit: results of IATROREF study: parts I and II.
Am J Resp Crit Care 2010; 181: 134-142

Krinsley JS
Glycemic variability: a strong independent predictor of mortality in critically ill patients

Weiss R and Lazar I
The need for continuous blood glucose monitoring in the intensive care unit.

Egi M, Bellomo R, Stachowski E, French CJ, Hart G.
Variability of blood glucose concentration and short-term mortality in critically ill patients.
Anesthesiology 2006; 105: 244-252

2.2. Debate on Tight Glucose Control

Krinsley JS and Preiser JC
Time in blood glucose range 70-140 mg/dL > 80% is strongly associated with increased survival in
non-diabetic critically ill adults
Critical Care 2015; 19: 179

Preiser JC
Glucose control
World Rev Nutr Diet 2013; 105: 82-89

Moderate glucose control is associated with increased mortality compared to tight glucose control
in critically ill non-diabetics
Chest 2013; 143: 1226-1234

Hirsch IB
Understanding Low Sugar from NICE-SUGAR

**Hypoglycemia and risk of death in critically ill patients.**


Mesotten D and Van den Berghe G

**Glycemic target and approaches to management of the patient with critical illness.**


**Intensive versus conventional glucose control in critically ill patients**


**Intensive insulin therapy in critically ill patients**


### 2.3. Health Economic Aspects of Glucose Monitoring


**A randomized trial of hyperglycemic control in pediatric intensive care**


Aragon D

**Evaluation of nursing work effort and perceptions about blood glucose testing in tight glycemic control**


Van den Berghe G, Wouters PJ, Kesteloot K, Hilleman DE

**Analysis of healthcare resource utilization with intensive insulin therapy in critically ill patients**

*Crit Care Med* 2006; 34(3): 612-616

Krinsley JS & Jones RL

**Cost analysis of intensive glycemic control in critically ill adult patients**

*Chest* 2006; 129(3): 644-650

Hilleman DE

**Cost considerations of tight glycemic control in the acute care setting**

*Semin Thorac Cardiovasc Surg* 2006; 18: 359-365

### 2.4. Glucose Monitoring - Examples of Fields of Application

#### 2.4.1. Neurology


**Systemic glucose variability predicts cerebral metabolic distress and mortality after subarachnoid hemorrhage: a retrospective observational study**

*Crit Care* 2014; 18: R89
Ooi YC, Dagi TF, Maltenfort M, Rincon F, Vibbert M, Jabbour P, Gonzalez LF, Rosenwasser R, Jallo J. 
**Tight glycemic control reduces infection and improves neurological outcome in critically ill 
neurosurgical and neurological patients**
Neurosurgery 2012; 71: 692-702

**Impact of hyperglycemia on neuropathological alterations during critical illness.**
J Clin Endocrinol Metab 2012; 97: 2213-2123

Kramer AH, Roberts DJ, Zygun DA 
**Optimal glycemic control in neurocritical care patients: a systematic review and meta-analysis**
Crit Care 2012; 16(5): R203

2.4.2. Burns

Jeschke MG 
**Clinical review: Glucose control in severely burned patients - current best practice**
Crit Care 2013; 17(4): 232

Kamolz LP, Pieber T, Smolle-Juttner FM, Lumenta DB 
**Optimal blood glucose control in severely burned patients: a long way to go, but one step closer**
Crit Care 2013; 17(5): 1005

Pisarchik AN, Pochepen ON, Pisarchyk LA 
**Increasing blood glucose variability is a precursor of sepsis and mortality in burned patients**

Jeschke MG, Kulp GA, Kraft R, Finnerty CC, Mlcak R, Lee JO, Herndon DN 
**Intensive Insulin Therapy in Severely Burned Pediatric Patients: A Prospective Randomized Trial**
Am J Respir Crit Care Med 2010; 182(3): 351-359

**Glucose variability is associated with high mortality after severe burn**
J Trauma 2009; 67(5): 990-995

Gauglitz GG, Herndon DN, Kulpo GA, Meyer WJ, Jeschke MG. 
**Abnormal Insulin Sensitivity Persists up to Three Years in Pediatric Patients Post-Burn**
J Clin Endocrin. Metab 2009; 94: 1656-1664
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3.1. **Need for Lactate Monitoring**

Zhang Z and Xu X  
**Lactate Clearance Is a Useful Biomarker for the Prediction of All-Cause Mortality in Critically Ill Patients: A Systematic Review and Meta-Analysis**  
Crit Care Med 2014; 42(9): 2118-2125

Bakker J, Nijsten MW, Jansen TC  
**Clinical use of lactate monitoring in critically ill patients**  

Lindsay AJ, Xu M, Sessler DI, Blackstone EH, Bashour CA  
**Lactate clearance time and concentration linked to morbidity and death in cardiac surgical patients**  

**Relative hyperlactatemia and hospital mortality in critically ill patients: a retrospective multi-centre study**  
Crit Care 2010; 14(1): R25

Jansen TC, van Bommel J, Schoonderbeek J, Sleeswijk Visser SJ, van der Klooster J, M, Lima AP, Willemsen SP, Bakker J  
**Early Lactate-Guided Therapy in ICU Patients: A Multicenter, Open-Label, Randomized, Controlled Trial**  
Am J Respir Crit Care Med 2010; 182: 752-761

Khosravani H, Shahpori R, Stelfox HT, Kirkpatrick AW, Laupland KB  
**Occurrence and adverse effect on outcome of hyperlactatemia in the critically ill**  
Crit Care 2009; 13(3): R90

Jansen TC, van Bommel J, Woodward R, Mulder PG, Bakker J  
**Association between blood lactate levels, Sequential Organ Failure Assessment subscores, and 28-day mortality during early and late intensive care unit stay: a retrospective observational study**  
Crit Care Med 2009; 37(8): 2369-2374

Bakker J and Jansen TC  
**Don’t take vitals, take a lactate**  
Intensive Care Med 2007; 33: 1863-1865

Polonen P, Ruokonen E, Hippelainen M, Poyhonen M, Takala J  
**A prospective, randomized study of goal-oriented hemodynamic therapy in cardiac surgical patients**  
3.2. Lactate Monitoring - Examples of Fields of Application

3.2.1. Sepsis
Puskarich MA, Trzeciak S, Shapiro NI, Albers AB, Heffner AC, Kline JA, Jones AE
Whole blood lactate kinetics in patients undergoing quantitative resuscitation for severe sepsis and septic shock
Chest 2013; 143(6): 1548-1553

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Outcome effectiveness of the severe sepsis resuscitation bundle with addition of lactate clearance as a bundle item: a multi-national evaluation
Crit Care 2011; 15(5): R229

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Sanchez-Sanchez M, Garcia-de-Lorenzo A, Herrero E, Lopez T, Galvan B, Asensio MJ, Cachafeiro L, Casado C
A protocol for resuscitation of severe burn patients guided by transpulmonary thermodilution and lactate levels: A 3-year prospective cohort study
Crit Care 2013; 17(4): R176

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Relevance of Blood Lactate Measurements as a Marker of Resuscitation in Patients with Severe Burns

Cochran, A
The Relationship of Serum Lactate and Base Deficit in Burn Patients to Mortality
J Burn Care Res 2007; 28: 231-240

3.2.3. Liver Surgery
Serum arterial lactate concentration predicts mortality and organ dysfunction following liver resection
Perioper Med (Lond) 2013; 2(1): 21

Watanabe I, Mayumi T, Arishima T, Takahashi H, Shikano T, Nakao A, Nagino M, Nimura Y, Takezawa J
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Shock 2007; 28(1): 35-8

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Transplant Proc 2004; 36(8): 2246-8

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