

CLINICIP

Closed Loop Insulin Infusion for Critically Ill Patients

Improved survival chances for critically ill patients and increased efficiency and safety in clinical practice: **CLINICIP** clinicians and scientists have joined forces in order to develop an intelligent glucose monitoring and control system for critically ill patients. The **CLINICIP** system will help to improve the survival chances in intensive care units and to increase efficiency and safety in clinical practice.

Objectives of the project

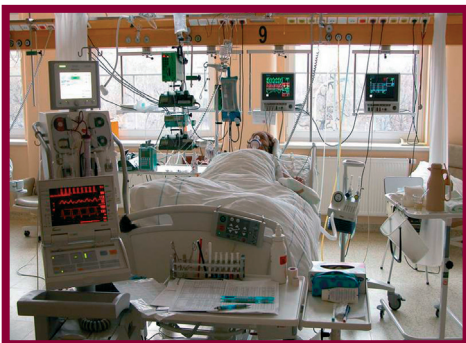
Hyperglycaemia and insulin resistance are common in critically ill patients, even when glucose homeostasis has previously been normal. Recent medical studies brought evidence that treatment of high glucose levels with insulin will dramatically improve survival chances in these patients. However, treatment of glycaemia with target glucose levels close to physiological range is labour-intensive and although the cause/effect is well-known, the unmanageable workload and the prevalent fear of hypoglycaemia among critical care physicians still prevent the general implementation of glycaemic control in the intensive care unit.

“Improving survival chances in intensive”

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physiological range is labour-intensive and although the cause/effect is well-known, the unmanageable workload and the prevalent fear of hypoglycaemia among critical care physicians still prevent the general implementation of glycaemic control in the intensive care unit.

Therefore, the overall goal of **CLINICIP** is to establish **glycaemic control on an automated basis** in order to improve survival chances in intensive care units.



Project Description

• Clinical research:

Clinical research follows a two-pronged approach, including basic physiology and clinical implementation. Physiological research focuses on the investigation of the properties and behaviour of adipose tissue under traumatic conditions and its suitability as a possible route for automated glucose measurement. To test components, subsystems, and finally the complete system as developed within the project, clinical studies are performed in a range of different intensive care units.

“Close co-operation of medicine and engineering”

• System development:

• **Sensor system:** Different sensor technologies are developed to measure the glucose concentration in blood and in interstitial fluid as delivered by the body interface. Additional metabolite sensors measuring lactate, carbon dioxide, oxygen and pH are developed and tested for the characterisation of adipose tissue.

• **Body interface:** The body interface plays a key role to connect the sensor technology with the critically ill patients. Different routes are investigated: The minimally invasive interstitial route as well as extravascular & intravascular approaches are being developed and clinically tested for continuous measurement of glucose and other metabolites.

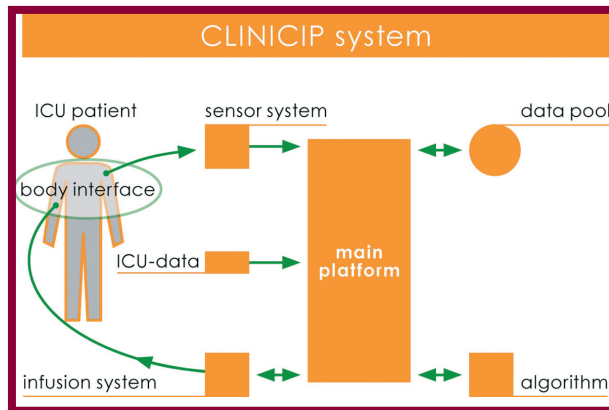
Scenario

Peter is 67 years old. He is overweight and has type 2 diabetes for 10 years. He suffered from a severe heart attack and needed cardiac surgical operation to repair the obstructed coronary artery that supplies blood to his heart muscle. The **CLINICIP** system will enable that Peter's blood glucose concentration after the operation will remain stable within normal limits. This will substantially decrease his risk of mortality, postoperational complications such as infections, impaired wound healing and might also reduce his length of stay in postoperational intensive care unit and overall stay in hospital.

- **Main platform:** Data as provided by the sensor system is transmitted to the main platform, which acts as the brain of the **CLINICIP** system. The platform interacts with the control algorithm, which calculates the insulin infusion rate. The main platform is developed in a stepwise approach - first as a decision support system still requiring manual glucose measurements and second as a control system with automated glucose measurement and insulin administration to facilitate tight glucose control.
- **Infusion system:** The infusion system acts as a second body interface of the **CLINICIP** system. In order to establish tight glycaemic control, the main platform communicates with the infusion system and actively regulates the intravenous insulin infusion.

• Data Management

Data from clinical studies are entered into a knowledge pool where the participating medical institutions can store and share their findings. Data and treatment recommendations may also be made available to hospitals outside the consortium in order to raise awareness about the importance of glycaemic control for critically ill patients. These centres will be invited to use the **CLINICIP** system to adapt their clinical work to the newly developed evidence-based practice and to expand the established knowledge pool.



Expected Results & Impacts

The overall goal of **CLINICIP** is the implementation of tight glycaemic control for critically ill patients on an automated basis in order to:

- reduce hospital mortality and morbidity,
- increase efficiency and safety in intensive care units,
- reduce workload of healthcare personnel and
- reduce health care costs.

Keywords:

Intensive care medicine,
Glucose monitoring,
Health care system

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- Katholieke Universiteit Leuven
(BE)
- The Chancellor, Masters and
Scholars of the University of
Cambridge (UK)
- B.Braun Melsungen AG (DE)

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Instrument: IP

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