GLUCOSE REGULATION IN INTENSIVE CARE

Many studies have shown that increased blood glucose (BG) levels are associated with an increased mortality. Since administration of insulin can lower the BG, it has been investigated if insulin administration lowers mortality in patients in the intensive care unit (ICU). Since 2001 a number of clinical studies have demonstrated that so-called intensive insulin therapy (IIT) indeed results in a lower mortality. Therefore ICU's in the Netherlands now strive to keep BG <8.3 mmol/L. The quality of IIT is even accepted as an important so-called quality indicator by the society of intensivists and by the Netherlands Healthcare Inspectorate. However, implementing IIT is not trivial. It has both important safety issues and important cost issues.

On the one hand high insulin dosages without sufficient control of BG can lead to abnormally low BG (hypoglycemia) with potentially catastrophic consequences. On the other hand, an insulin dose that is too low can lead to persisting hyperglycemia. Insulin doses are usually determined with paper protocols or after consultation with a physician. Depending on the specific protocol, this approach requires 4 to 20 blood samples per day to check the BG. The cost of IIT is significant: for the Netherlands with more than 1000 ICU beds, the costs will be at least be 10 M€/year, but may well be considerably higher.

For a number of years the University Medical Center in Groningen (UMCG) uses the so-called Glucose Regulation in ICU Patients (GRIP) computer system. The primary objective for the introduction of GRIP was the improvement in safety of IIT. The GRIP-algorithm provides advice to the ICU nurse on the next setting of insulin pump and the time at what time the next BG should be measured. The algorithm was based on the previously established paper protocols and expert experience. GRIP uses a several parameters including BGs and insulin administration. It was quickly accepted by personnel. GRIP has also led to a drastically lower occurrence of hypoglycemia in comparison with most other studies. Moreover GRIP requires fewer BG measurements than other protocols. Presently several thousand patients haven been treated by GRIP in the UMCG.

Objectives: This project is suitable for a double Math/Comp.Science BSc student, or a BSc student in Mathematics with strong computer skills. The data collected by the GRIP system will be made available in the XML format. The goal is to analyse performance of the GRIP algorithm (development of the evaluation criteria is also part of the assignment). Though GRIP is extremely safe (occurrence of hypoglycaemic events is very low), we would like to understand whether those rare events could have been avoided (i.e., predicted). Second objective is to investigate whether even lower BG values could potentially be achieved without jeopardising patient safety.

Further information:

[1] GRIP WWW page

[2] M. Vogelzang, F. Zijlstra, and M. Nijsten, Design and implementation of GRIP: a computerized glucose control system at a surgical intensive care unit, BMC Medical Informatics and Decision Making 2005, 5:38. [Link]

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