Estimation of micronutrient status in ICU-patients.

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Description of the initiative

- **Background:** Micronutrient status, essential for metabolic, antioxidant and immune functions, is mostly estimated by plasma concentrations. These are frequently decreased (up to 90%!) in ICU-patients due to real losses through bodily fluids or increased metabolic use and/or apparent deficiencies caused by redistribution due to inflammation: plasma levels do not adequately reflect body status. There are no reliable means to correct for inflammation. Micronutrient administration in patients without a real deficiency may even be deleterious. For example, in certain circumstances vitamins C and E may destroy the normal homeostatic immune equilibrium by upregulation of proinflammatory cytokines.
- **Rationale for the initiative:** Intracellular measurements in erythrocytes or leucocytes might be a better estimate of micronutrient status in ICU-patients and might be used for personalized supplementation.
- **Objectives and scope**
- 1. To measure simultaneously vitamin B1/B6/B11/C/D/E, zinc and selenium in plasma, erythrocytes and leucocytes in 20 ICU-patients on day 1,3,5,7 and in 20 healthy volunteers (2 random samples).
- 2. To correlate plasma and intracellular concentrations of micronutrients with CRP, α-1 acid glycoprotein, prealbumin and severity of organ dysfunction (Δ SOFA-score).

Planned activities & deliverables

- **Outline the steps to be taken** Development and validation of measurements in erythrocytes and leucocytes: vitamin B1, B6, C and E by liquid chromatography–mass spectrometry (LC-MS), vitamin B11 and D by immunoassays, and zinc and selenium by atomic absorption spectrometry (AAS).
- **What are the concrete deliverables of the project?** To obtain more reliable estimation of micronutrients in ICU-patients for personalized micronutrient treatment.
- **What achievements are possible in the next 12 and 24 months?** In the next 12 months we plan to develop and validate the intracellular analyses of micronutrients. From 13 – 24 months we plan to perform the study with serial measurements in 20 ICU patients and 2 random samples in 20 healthy volunteers.

Resources & enablers

- **Describe personnel, financial needs** A crucial part of this project is the laboratory work: 1. to determine the most simple but still reliable method of processing of the samples for separation and isolation of plasma, erythrocytes and leucocytes 2.to validate the laboratory analyses of the micronutrients in the new matrices (€30.000). In addition, costs for laboratory and medical personnel will be made (€60.000).
- **Specify how the grant will be spent** If we would obtain the grant, we could start the first crucial steps of this project with development and validation of these new laboratory analyses.
- **What factors will make it successful?** The laboratory facilities of the Reinier de Graaf hospital are exquisite and all the necessary equipment (LC-MS and AAS) is available. The infrastructure of the research group location VUmc will support the logistics of this project and the inclusion of patients. National (Prof. Weijs) and international (Prof. Berger, Prof. Casaer, Prof. de Waele) experts of nutrition and micronutrients give scientific support on this project.

Results/outcomes & expected impact

- **How will the findings be implemented?** After determining the differences between plasma and intracellular concentrations of micronutrients in ICU-patients, we will investigate whether supplementation based on intracellular concentrations yields better results compared to supplementation based on plasma concentrations in an RCT.
- **How will this project advance patient care / contribute to optimal nutritional care?** The results can aid to optimize micronutritional status crucial for metabolic, antioxidant and immune function and therefore potentially clinical outcome in ICU-patients.
- **What makes the project innovative?** Intracellular measurements, especially in leucocytes, have only been performed sporadically for very few micronutrients and only occasionally in ICU-patients.
- **Will the project be likely to influence national nutrition policy?** Possibly after the follow up RCT.
- **Is the project transferable to other settings / countries?** If intracellular measurements turn out to be more reliable, this project is transferable to all patients with inflammation and to all countries with sufficient laboratory support.

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