

Microdialysis - a sampling technique to measure biochemistry directly in the tissues

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Introduction

Microdialysis is a technique for sampling the chemistry of the interstitial fluid of tissues and organs in animal and man. A dialysis membrane at the distal end of a microdialysis catheter functions like a blood capillary. Chemical substances from the interstitial fluid diffuse across the membrane into the perfusion fluid inside the catheter. The fluid is collected bedside ready for chemical analysis. The availability of modern analytical techniques has made the microdialysis catheter a “universal” biosensor capable of monitoring essentially every small molecular compound in the interstitial fluid of endogenous as well as exogenous origin.

Today microdialysis is a standard technique in physiological and pharmacological investigations and an emerging technique in the field of intensive care monitoring. It provides crucial information about how seriously cells are affected by for example ischemia, hyperemia, trauma, hemorrhage, vasospasm as well as various physiological, pharmacological and surgical interventions during intensive care.

Chemical markers of tissue biochemistry

The lactate/pyruvate ratio is a well-known marker of changes in the redox state of cells caused by e.g. ischemia. The use of a ratio between two analytes abolishes the influence of alterations in catheter recovery as such changes influences lactate and pyruvate to a similar degree. Therefore the lactate/pyruvate ratio can be used to compare the redox state of different tissues in one individual as well as between different individuals. The normal ratio is essentially the same in all tissues i.e. 15-20 while a ratio above 25 is a sign of tissue ischemia.

Glycerol is used as a marker of cell damage as it is an integral component of cell membranes. Loss of energy due to ischemia leads to an influx of calcium into cells, activation of phospholipases and eventually to a decomposition of cell membranes, which liberates glycerol into the interstitial fluid.

New Concepts in Data Analysis

Microdialysis provides a new bedside variable, adding to the already massive amount of information that has to be understood and acted upon by the intensive care staff. It requires more than “standard” knowledge of tissue biochemistry and it becomes truly useful only when it is integrated with already existing bedside information. In order to provide such an integration we have developed a new software, ICU-Pilot, collecting data from essentially all bedside devices. It has a unique user interface allowing real time comparisons of different measurements, which greatly facilitates the integration of tissue biochemical data into routine intensive care.