

Early detection of secondary insults & software for Multimodal Monitoring

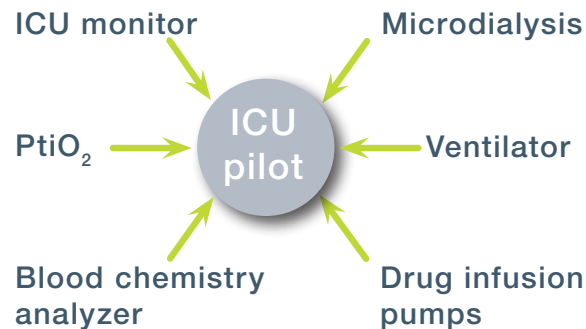
At a Consensus Meeting, a panel of international experts agreed upon the following recommendations (publications see last page):

Traumatic brain injury: In patients with diffuse injury one catheter may be placed in the right frontal region. In patients with focal mass lesions one catheter should be placed in periconfusal tissue. The lactate/pyruvate ratio is a sensitive marker of brain redox state and secondary ischemic injury. Glucose, glycerol, and glutamate are additional markers of developing ischemia or cell damage.

Subarachnoid Hemorrhage (SAH): The catheter should be placed in the tissue at risk (most likely the parent vessel territory). Glutamate and lactate/pyruvate ratio are sensitive markers for the development of ischemia.

ICUpilot - software for multimodal monitoring

ICUpilot is a unique tool for multimodal monitoring in the ICU. Bedside Patient Monitors (showing e.g. pulse, blood pressure, ICP, CPP) as well as the Microdialysis Analyzer can be connected to a separate computer for on-line analysis and comparison of all data collected bedside during the entire care of the patient.



Literature:

Implementation of cerebral microdialysis at a community-based hospital: A 5-year retrospective analysis. Surg Neurol Int. 2012 Chen et al. Department of Neurosurgery, Legacy Emanuel Medical Center, Portland, USA.

Neurochemical Monitoring of Therapeutic Effects in Large Human MCA Infarction. Neurocrit Care 2008. Apr 15. Berger C et al, Department of Neurology, University of Heidelberg,

Consensus meeting on microdialysis in neurointensive care. Intensive Care Med. 2004 Dec;30(12):2166-9. Bellander BM, Cantais E, Enblad P, Hutchinson P, Nordström CH, Robertson C, Sahuquillo J, Smith M, Stocchetti N, Ungerstedt U, Unterberg A, Olsen NV.

Delayed neurological deficits detected by an ischemic pattern in the extracellular cerebral metabolites in patients with aneurysmal subarachnoid hemorrhage. Journal of Neurosurgery 2004. Jane Skjoth-Rasmussen, Mette Schulz, Soren Risom Kristensen, Per Bjerre.

Microdialysis: Is it ready for prime time? Review. Current Opinion in Critical Care 2009,15:110-117 J. Clay Goodman and Claudia S Robertson. Department of Pathology, Neurology and Neurosurgery, Baylor College of Medicine, Houston, Texas, USA.

Bedside Diagnosis of Mitochondrial Dysfunction After Malignant Middle Cerebral Artery Infarction. Nielsen TH, Schalén W, Ståhl N, Toft P, Reinstrup P, Nordström CH. Neurocrit Care. 2013 Jul 17

M Dialysis AB

M Dialysis AB is the leading company devoted to the development, manufacturing and marketing of the Microdialysis technique.

The head office is located in Stockholm, Sweden, with a subsidiary in Boston MA, USA. M Dialysis has distributors across the globe, responsible for local sales, service and support.

 **dialysis**

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Distributor

Microdialysis

Advanced monitoring in neurointensive care



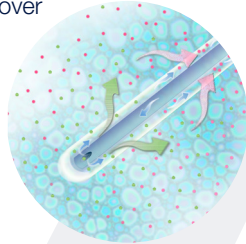
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 **dialysis**

Microdialysis in Neurointensive Care

Microdialysis is a tool for *in vivo* sampling of soft tissues that utilizes the principal of diffusion through a semi-permeable membrane. The technology is minimally-invasive, easy to handle, and may be used continuously over a period of several days.

The method is performed by inserting a Microdialysis catheter into the tissue being studied. The Microdialysis membrane of the catheter is in direct contact with the soft tissue.



The catheter is perfused with a sterile isotonic solution via a small pump attached to its inlet lumen. In the tissue, substances from the interstitial fluid diffuse through the semi-permeable Microdialysis membrane into the perfusion fluid. This fluid, now known as dialysate, moves through the outlet lumen and into a collection microvial. Microvials are exchanged at regular intervals. The dialysate collected may be analyzed both immediately using the ISCUS^{flex} Microdialysis Analyzer as well as later in the laboratory using additional analytical techniques (if desired).

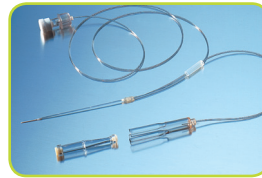
The metabolite values in the dialysate provide a picture of the local tissue metabolism. This has been particularly useful in neurointensive care as there are well described metabolic changes that occur with secondary ischemic events in the cases of traumatic brain injury (TBI) and subarachnoid hemorrhage (SAH).

Secondary ischemia is a frequent and serious complication affecting patient outcome. Since Microdialysis allows continuous surveillance of cerebral metabolism in a clinical setting, secondary ischemia or mitochondrial dysfunction can be recognized at an early stage. Thus, the technique opens a window of opportunity for therapeutic interventions.

Microdialysis sampling

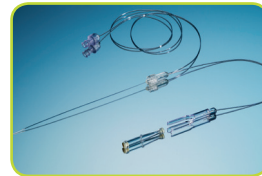
Microdialysis sampling is carried out by placing the sterile CE-certified Microdialysis catheter in the brain parenchyma. All Brain Microdialysis Catheters have a gold thread in the tip so confirmation of placement can be verified by CT.

70 Brain Microdialysis Catheter



- Free positioning and fixation by tunnelation
- Available in different shaft and membrane lengths

70 Bolt Microdialysis Catheter



- Access and fixation using a bolt system

71 High Cut-off Brain Microdialysis Catheter



- Free positioning and fixation by tunnelation
- High Cut-off membrane enables the diffusion of high molecular weight substances e.g. cytokines

106 and 107 Microdialysis Pump

The 106 and 107 Microdialysis Pumps are dedicated for the perfusion of Microdialysis catheters with sterile isotonic perfusion fluid. Both pumps are battery driven.

The 106 Microdialysis Pump operates at a fixed flow rate of 0.3 $\mu\text{l}/\text{min}$. The flow rate of the 107 Microdialysis Pump can be set stepwise between 0.1 – 5.0 $\mu\text{l}/\text{min}$.



ISCUS^{flex} Microdialysis Analyzer

The ISCUS^{flex} Microdialysis Analyzer is specially designed to handle small sample volumes. It is a point of care analyzer for monitoring metabolic changes in tissues and organs during surgery, in intensive care and normal ward.

Biochemical markers:

Glucose

Lactate

Pyruvate

Glycerol

Glutamate

Urea



The ISCUS^{flex} Microdialysis Analyzer is easily operated by medical professionals. It provides unique opportunities for early detection of metabolic crisis, ischemia and to guide post-operative interventions. Data is displayed as trend curves for easy and fast interpretation.