

# Saving free flaps, reducing healthcare costs

Monitoring metabolic markers with Microdialysis



Following microvascular free flap surgery, it is essential to monitor the perfusion of the transferred flap because of the risk of anastomotic failure and ischemia. Monitoring of the flap is commonly made by clinical observation of signs that appear following arterial or venous ischemia.

## Metabolic monitoring offers early signs of complications

Microdialysis is a unique technique, which offers the possibility to continuously monitor the metabolism of the flap. Ischemia can be detected by monitoring the changes in Glucose, Lactate, and Pyruvate levels in interstitial fluid of the specific tissue.<sup>1</sup> Microdialysis can reliably detect flap ischemia at an early stage.<sup>2</sup>

The performance of the analysis is easy and can be done by even less experienced nursing staff working in institutes with a low frequency of microsurgery.<sup>2</sup>

## Excellent studies confirm results

In a recent Finnish study<sup>2</sup> Microdialysis was used in the follow-up of 80 consecutive microvascular flaps. The salvage rate of all thrombosed flaps was 77 percent, with a final success rate in microvascular reconstruction of 95 percent. No flap was lost due to a delay in the diagnosis of secondary ischemia, if on-line Microdialysis monitoring was available. All thromboses were clearly recognized by Microdialysis via a decrease in the Glucose concentration in the tissue and an increase in the Lactate concentrations.

In another Finnish prospective study<sup>1</sup> twenty-five consecutive patients who underwent oral cavity/oropharynx cancer resection and immediate reconstruction with free flaps were monitored with Microdialysis. Two flaps out of 25 failed in spite of reoperations. In both problem cases, Microdialysis indicated ischemia 1 to 2 hours before it became clinically evident. During flap ischemia, the Lactate/Pyruvate ratio increased to a level clearly above 25, and at the same time the Glucose concentration diminished and remained below 0.4 mmol/L, whereas the Lactate level increased.

Microdialysis has several advantages compared to other monitoring techniques: objective measurements, different curves for venous and arterial thrombosis and early diagnosis.<sup>3</sup> It is a clinically feasible and sensitive monitoring method for all kinds of microvascular flaps, especially for those in which clinical observation is difficult or impossible.<sup>2</sup>

In a Danish study<sup>4</sup> fourteen women who underwent reconstruction with a free TRAM flap were monitored with Microdialysis. During flap ischemia, the concentration of Glucose was reduced, while the Lactate and Glycerol levels increased. The differences between the flaps and controls were statistically highly significant. The study concluded that Microdialysis could detect ischemia in free flaps at an early stage making early surgical intervention possible.

## Improved patient comfort

Repeated clinical examination of an intraorally located flap causes significant discomfort for the patient. A Microdialysis catheter is a minimally invasive device, which offers the possibility to monitor the flap continuously. Without any patient discomfort, metabolic markers and early signs of Ischemia can be monitored bedside with a portable analyzer.

## A theoretical cost benefit example

How can we estimate the price of a lost free flap? A new flap including a large second operation and delays can cost the hospital up to €25.000, and in some cases even more.

In almost all cases of primary flap failure it will be possible to save the flap if ischemia is detected without delay. Only in very few cases detection of ischemia is not enough to save a free flap; cases where the vessels or the patient as such are in a condition obstructing further salvage procedures.<sup>5</sup>

- Plastic surgery clinic with 50 patients/year
- Cost of Microdialysis consumables approx. €500 per patient
- Cost of investing in an ISCUS Analyzer €30.000, written off for three years
- Cost of a lost flap and additional ICU stay approx. €25.00

Not using Microdialysis	Year 1	Year 2	Year 3	Total
Patients per Year	50	50	50	150
Flap failure rate	5%	5%	5%	
Cost of lost flaps (€)	-62 500	-62 500	-62 500	-187 500

Monitoring with Microdialysis	Year 1r 1	Year 2	Year 3	Total
Patients per Year	50	50	50	150
Flap failure rate	1%	1%	1%	
Cost of lost flaps	-12 500	-12 500	-12 500	-37 500
Cost of Consumables	-25 000	-25 000	-25 000	-75 000
Cost of Analyzer	-10 000	-10 000	-10 000	-30 000
Total cost including Microdialysis (€)	-47 500	-47 500	-47 500	-142 500

Summary	Year 1r	Year 2	Year 3	Total
Annual savings of using Microdialysis	15 000	15 000	15 000	45 000
Total Microdialysis costs - per patient				-700
Reduced costs for lost flaps - per patient				1000
Financial savings per patient (€)				300

## Conclusions

Microdialysis is a reliable and simple method with clear clinical benefit. Several centers in Europe are currently using Microdialysis on a clinical routine basis. By using Microdialysis for postoperative monitoring, total costs of healthcare can potentially be significantly reduced. The real benefit of saving a flap cannot be measured in money.

1 Janne Jyranki, Sinikka Suominen, Jyrki Vuola, and Leif Back. Microdialysis in Clinical Practice Monitoring Intraoral Free Flaps. Ann Plast Surg 2006

2 Leena Setälä, Anthony Papp, Eeva-Liisa Romppanen, Paula Mustonen, Leena Berg, M.D., and Markku Harma Microdialysis Detects Postoperative Perfusion Failure in Microvascular Flaps Journal of reconstructive Microsurgery 2006

3 Brix M, Muret P, Mac-Mary S, Ricbourg B, Humbert P. Microdialysis of cutaneous free flaps to monitor results of maxillofacial surgery. Rev Stomatol Chir Maxillofac. 2006

4 Udesen A, Lontoft E, Kristensen SR. Monitoring of free TRAM flaps with microdialysis. J Reconstr Microsurg. 2000

5 In courtesy of Birke H Sorensen Department of Plastic Surgery, Århus, Denmark