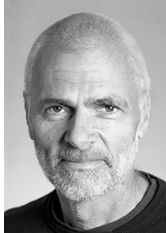


Transcutaneous monitoring - a Danish approach

September 2003



Gorm Greisen

MD, DrMedSci
Head of the Department of Neonatology
Copenhagen University Hospital
Department of Neonatology
Afsnit 5023
Blegdamsvej 9
DK-2100 Copenhagen
Denmark

Danish neonatal intensive care units (NICUs) are known throughout the world for practicing minimal handling. Because it is non-invasive, transcutaneous monitoring of pO_2 and pCO_2 plays an important role in this setup.

acutecaretesting.org has interviewed Professor Gorm Greisen, MD, Dr. Med. Sci., and Head of the Department of Neonatology of the Copenhagen University Hospital in Denmark about their use of transcutaneous monitoring.

Babies are left undisturbed

The NICU of the Copenhagen University Hospital has been using transcutaneous monitoring of oxygen and carbon dioxide as part of their patient monitoring since 1978. Transcutaneously monitored patients at the NICU include mechanically ventilated preterm babies (it is a hospital standard that all mechanically ventilated preterms must be transcutaneously monitored), as well as babies suffering from congenital heart disease.

Transcutaneous monitoring is also used during pre-

and postoperative care and patient transport. Not only neonates but also young pediatric patients are monitored transcutaneously.

Other monitoring methods to supplement transcutaneous values include pulse oximetry, which is widely used, and arterial blood gas measurements. End tidal measurements are rarely used. Gorm Greisen explains: "We do have a few end tidal capnographs, which we use during patient transport.

However, we will soon start using end tidal to check proper tube placement after intubation. The problem is that in newborn babies with small tidal volumes, end tidal underestimates arterial pCO_2 values by 30 to 70 %."

According to Gorm Greisen, it is important to correlate transcutaneous monitoring results with those obtained by other methods.

What if a sudden discrepancy in values occurs? Gorm Greisen explains: "We always evaluate the total picture.

If $tcpCO_2$ increases and other values appear normal, we check whether the transcutaneous electrode needs recalibration instead of rushing to take a blood sample.

Ideally, continuous monitoring should minimize the need for arterial blood sampling. Some hospitals have a routine of drawing blood every six hours or every morning. Not here, though. If the transcutaneous readings are stable, the babies are left undisturbed."

Shorter lengths of stay

According to Gorm Greisen, it is difficult to scientifically prove that transcutaneous monitoring leads to improved patient outcome. In his opinion, "studies can show how effective a monitoring method is, but it is hard to prove how a single method affects the clinical outcome."

When asked about the financial advantages of using transcutaneous monitoring, e.g. shorter length of stay, Gorm Greisen replies: "I have never thought of transcutaneous monitoring as a way to shorten length of stay, but rather as a way to diagnose a patient.

But I suppose that the better you can diagnose patients, the less likely complications are to arise, and that of course can lead to a shorter length of stay."

Pros and cons of transcutaneous monitoring

The monitoring method, like any other, has its advantages and disadvantages. But for Gorm Greisen, the benefits of continuous monitoring outweigh any drawback: The main advantage of transcutaneous monitoring is the ability to monitor oxygen and carbon

dioxide continuously - and non-invasively.

"Many hospitals use only arterial blood gas samples and pulse oximetry to monitor oxygen and carbon dioxide," explains Gorm Greisen. "However, these two methods alone do not provide continuous monitoring of pCO_2 , and that can be a problem.

A lot can happen to a critically ill preterm baby in the course of 30 minutes. Carbon dioxide can rise - or fall - dramatically. When you don't have continuous monitoring of pCO_2 , the chances of detecting those changes and reacting to them in time become smaller."

Nurses conduct all transcutaneous monitoring in the hospital. Training in the method is part of their general training. Staff turnaround is very high: 25 % of all nurses have been at the unit for less than a year.

Therefore, keeping the staff properly trained is a big challenge. "Transcutaneous monitors are not the only instruments nurses use," says Gorm Greisen. "Therefore, operational simplicity is essential."

Even though using a transcutaneous monitor is not particularly difficult, there are a series of procedures that nurses need to be aware of to ensure correct readings. Procedures include how to fasten electrodes properly onto the fixation rings and where to place them on patients. "These may seem like small details, but you have to be aware of them in order to ensure correct results," says Gorm Greisen.

Gorm Greisen evaluates the benefits and drawbacks of transcutaneous monitoring as follows:

Pros	Cons
<ul style="list-style-type: none">• Continuous monitoring of carbon dioxide• Continuous monitoring of oxygen• Non-invasive• Early warning of changes in patient status• Minimizes the need for drawing arterial blood gas samples• Transcutaneous monitors are not particularly difficult to operate - require little training• Electrodes can last up to two years	<ul style="list-style-type: none">• Ageing of the electrodes may cause high $tcpCO_2$ readings. Nurses therefore need to be aware of the problem and know how to detect it• Heating the skin can lead to small burns• Transcutaneous technology and consumables can be a fairly expensive investment for a hospital

Get users involved

For those hospitals wishing to invest in transcutaneous technology, Gorm Greisen recommends getting the nursing staff involved as much as possible in the process.

“Sometimes doctors attend commercial conferences and get excited about a product,” he explains. “But if nurses - the users - cannot see the value in them, these products end up not being used. The users must be involved in the process. They must see how this equipment will help them in their everyday care for the patients. Or else the technology will never be used.”

Interviewers

Ana Cristina Magalhães and **Gitte Juel**

Radiometer Medical A/S

Åkandevvej 21

DK-2700 Brønshøj

Denmark

The Department of Neonatology - Copenhagen University Hospital:

- Established in: 1964
- Level: 3
- Number of beds: 38
- Births/year: 30,000
- Number of employees: over 150, including doctors, nurses, and technicians
- Ratio of local patients versus patients from other parts of the country (including Greenland and the Faroe Islands): 45/55
- Collaborating departments: Obstetrics, Pediatrics, ICU, and OR
- Common causes of admittance: prematurity, cardiac and surgical problems in newborns, and need for intensive care.
- Average length of stay: 10 days. 15 % of patients are discharged home after that. The rest are discharged to their mothers in the maternity ward, to other pediatric departments in the University Hospital, or to pediatric departments in other regional hospitals.
- Methods of ventilatory support: CPAP is the primary method of ventilatory support (very normal in Scandinavia, which is known for practicing minimal handling at the NICUs). Mechanical ventilatory methods include ECMO, NO-therapy, and HFO. BIPAP is only used in extreme cases.