Transcutaneous Blood Gas Monitor

Health problem addressed
Monitors partial pressure of CO2 at the skin surface of patients at risk of hypoxia or inadequate ventilation or in whom clinically significant metabolic changes may be detected as changes in tcpCO2 (e.g., patients under general anesthesia, patients with emphysema). Transcutaneous blood gas monitoring can be used as a supplement—or, in some cases, as an alternative—to periodically drawing and analyzing arterial blood.

Product description
Rectangular or square device with wires connecting to patient measurement sensors; additional input/output channels may be available; display (LED, LCD) indicates patient blood gas levels; buttons or dials for control settings; may include thermal printer; sensors are usually small and round, attached to patient’s skin with adhesive.

Principles of operation
TcpCO2 is monitored by a small sensor, which houses a pH electrode, a reference electrode, an electrolyte solution, a Teflon membrane, and a heating element. An adhesive ring fastens the sensor to the skin. The heating element warms the skin to 42° to 45°C. The CO2 that diffuses through the stratum corneum by the warming of the skin passes across the sensor’s semipermeable membrane and into a diluted bicarbonate solution (electrolyte solution) in the sensor chamber. Adding CO2 lowers the pH of the solution (increases acidity); a glass electrode measures the change. The electrode’s output is converted into a signal, which the instrument records as tcpCO2.

Operating steps
Sensors are affixed to patient skin; device is programmed by operator (i.e., turned on, measured parameters may be chosen); device takes periodic or continuous blood gas measurements and alarms if measurements are outside of normal range. Periodically location of sensor must be changed to a different place on patient’s skin to avoid irritation or burns, some devices include a site-change timer.

Reported problems
Varying degrees of burns can result from the sensor’s elevated temperature. Thin-skinned infants and patients with peripheral vascular impairment are especially at risk. Frequent sensor relocation, as recommended by the manufacturer, can help prevent burns; however, sensor relocation often entails recalibration.

Use and maintenance
User(s): Medical staff
Maintenance: Biomedical or clinical engineer
Training: Initial training by manufacturer and manuals

Environment of use
Settings of use: Hospital
Requirements: Line power

Product specifications
Approx. dimensions (mm): 100 x 300 x 200
Approx. weight (kg): 0.5-5
Consumables: Sensors, probes, calibration materials
Price range (USD): 7,225 - 20,000
Typical product life time (years): 8
Shelf life (consumables): Disposable sensor membranes: 2 weeks; reusable sensors: 2 months

Types and variations
Modular unit (connected to other patient monitoring devices) or stand-alone; specialized for adult, pediatric, or neonate; most measure both tcpCO2 and tcpO2; some measure tcpCO2 and SpO2; reusable or disposable sensors