The measure of life.

A unique non invasive, beat to beat, real time haemodynamic monitor.
**Transform the way you think and practice**

**Painting a clear picture – instantly**

USCOM’s unique, non invasive method of haemodynamic monitoring is a completely safe, painless and efficient way of measuring how well the heart is functioning. The USCOM monitor allows doctors and nurses to quickly and accurately assess a patient’s haemodynamic status, categorise a problem as either cardiac or vascular abnormality and monitor the patient’s response to therapy.

The USCOM monitor uses proven, state-of-the art continuous wave Doppler ultrasound technology with sophisticated, real time signal processing and an intuitive user interface. The USCOM is a novel, non invasive solution for the accurate measurement of cardiac flow.

![Image of a medical device]

**Rational approach to haemodynamic management**

To maintain a normal Blood Pressure (BP), the autonomic system increases Systemic Vascular Resistance (SVR) in response to a drop in Cardiac Output (CO) and vice versa. While BP stays relatively normal in compensated phase, during decompensation BP drops because SVR is no longer able to manage a failing circulation. Having beat to beat Stroke Volume (SV) allows for earlier detection and rapid intervention.

**Circulatory Management = Optimise Stroke Volume**

**Stroke Volume Resuscitation**

Monitoring Stroke Volume (SV) is especially effective in understanding a patient’s response to therapy. Optimising fluids can be guided easily and safely. An increase in SV during fluid resuscitation would typically indicate a hypovolaemic state, a decrease in SV a hypervolaemic state and no change a normovolaemic or optimised pre-load. Monitoring SV is equally effective in managing contractility, afterload and oxygen delivery.

**OXYCOM**

The objective of circulatory therapy is to optimise oxygen delivery to the cells. This can be achieved by increasing SpO₂ or CO. Using pulse oximetry and inputting the haemoglobin (Hb) value, the USCOM monitor calculates DO₂ on a beat to beat basis (requires OXYCOM option).

**Applications**

- Paediatrics, PICU, NICU
- Emergency medicine – ED and remote (transport, military and field)
- ICU – general, surgical and post cardiac
- Anaesthesia
- Heart failure and Electrophysiology
- Hypertension / Eclampsia
- Dialysis
- Sports medicine
- Veterinary medicine
- Pharmacology and Animal research

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**Equipment with FlowTracer**

- Real time, beat to beat display
- One touch measurement recording
- Advanced trending functionality
- Manual override feature
- Fast patient assessment and treatment
- Storing graphical and numerical data
- SVR capability
- DO₂ and SpO₂ capability with OXYCOM

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**Reduce risk. Minimise cost. Improve care.**

**The USCOM monitor is safe**

Unlike invasive methods, with the USCOM monitor there is no exposure to blood, and no associated risks of infection or complications. The examination may be performed as often as desired, with no risk to the patient. No sedation is required, making it suitable for all patients, saving on drug use and inherent complications.

**Rapid recognition of haemodynamics could make the difference in an emergency situation**

The USCOM monitor provides clinicians and paramedics with vital haemodynamic information, allowing for rapid diagnosis and effective treatment, at the scene and during patient transport. The USCOM monitor can also help to avoid contraindicated therapies, which may put the patient under unnecessary trauma and risk.
CASE STUDY
Response to fluid therapy measured by CVP and USCOM.

DR ROBERT BILKOVSKI
Department of Emergency Medicine, Henry Ford Hospital, Detroit, Michigan, USA

Presentation
82 year old male
Septic shock with hypotension, tachycardia
Pneumonia infection
Blood pressure maintained on vasopressors: norepinephrine (0.5mcg/min) and neosynephrine (200mcg/min)

Observations
Baseline observations
HR = 139bpm, BP = 71/38mmHg (MAP = 45mmHg) and CVP = 13mmHg.
Baseline USCOM
HR = 136bpm, SV = 22cm³, CI = 3.0l/min/m², CO = 3.6l/min, SVR = 853.

Intervention
The patient had an infusion of 25gm of fluid over 20 minutes in response to low CO, CI and SV; a high HR, and hypotension.

Post Infusion Observations
HR = 117bpm, BP = 109/56mmHg (MAP = 76mmHg) and CVP = 13mmHg (unchanged).

Post Infusion USCOM
HR = 115bpm, SV = 36cm³, CO = 4.3l/min/m², CI = 2.3l/min/m², SVR = 1141.

Discussion
CVP directed haemodynamic optimisation goals of >12mmHg were satisfied at rest with CVP of 13mmHg, suggesting no need for fluid infusion. Baseline CO, CI and SV were inadequate as was BP, suggesting the need for fluid. Post fluid CVP was unchanged at 13mmHg, while objective flow measurements from USCOM were significantly increased. SV was increased by 45% and CO by 45%.

Conclusion
USCOM identified significant SV reserve and SV fluid responsiveness not detectable using invasive CVP haemodynamic goals. Appropriate assessment of cardiac output is improved by objective beat to beat understanding of the flow.

USCOM Features:
• Non invasive, safe and well tolerated
• Real time left and right heart output
• Validated, all ages and all outputs, from neonates to geriatrics
• Compact and easily transportable
• Fast set-up and no calibration needed
• Comprehensive trending feature
• Patient report generation and data export feature
• Intuitive touch screen user interface
• Two-hour battery operation
• 40GB hard disk with large patient archive
• Can be operated by physicians, nurses and paramedics

Simple application of goal directed therapy
• Optimise fluids
• Monitor and titrate drug therapy
• Manage septic shock
• “Smart Resuscitation”

Quantitative information to guide therapy

USCOM prior to Passive Leg Raise Test SV = 48cm³
USCOM after Passive Leg Raise Test SV = 58cm³

Figure 1
USCM screen of trend data demonstrating measures from baseline (at left) with increased CO, SV and CI and the post bolus value (on right). This case helps to illustrate that measurement of central venous pressure for the purposes of assessing intravascular volume status has limitations.

Invasive pressure measurements provide crude analogues of circulation. USCM’s real time monitoring of the interplay of SV and HR at rest and during intervention optimizes such observation.

CASE STUDY
Correct treatment of the rapidly recognised high output state achieved a faster patient recovery.

ASSOCIATE PROFESSOR BRENDAN E. SMITH
School of Biomedical Science, Charles Sturt University, Specialist in Anaesthesia and Intensive Care, Bathurst Base Hospital, Bathurst, NSW, Australia

Presentation
24 year old female 58Kg. Previously fit and well. Only medication is oral contraceptive pill. Brought in by ambulance as “collapse”.

Observations
Baseline observations
Patient very confused and little history available. GCS 5-6. BP 73/42, pulse 80, Temp 38.3, Oxygen sat 92% on 4l/min O₂. Respiratory rate 24/min. Sweets right calf and foot visibly swollen.

Initial diagnosis

Baseline USCOM
HR = 115bpm, SV = 36cm³, CI = 2.3l/min/m², SVR = 1141.

Differential diagnosis
Closer clinical examination revealed 8 x 5cm patch of cellulites on upper inner right thigh with small ischemic areas within. Inguinal lymphadenopathy present on right. Infection confirmed as streptococcus from wound swabs and same organism found in blood culture.

Intervention
The patient was successfully treated with vasopressors.

Discussion
USCM allowed for rapid differential diagnosis of septicemia, resulting in choice of the correct treatment and a faster and full recovery of the patient.

Beat to beat data displayed for all parameters including:
- CO (l/min)
- SV (cm³)
- SVR (mmHg)
- HR (bpm)
- CI (l/min/m²)
- SVI (cm²/m²)
- SV (%) Stroke Volume
- SV (%) Stroke Volume Variability
- SV (%) Heart Rate
- SV (%) Systematic Vascular Resistance
- SV (%) Systematic Vascular Resistance Index
- CPO (Watts)
- SW (ml)
- DO (l/min)
- SpO₂ (%)
- SVV (cm²)
- MD (mm)
- Vpκ (m/s)
- v6 (l/min)
- PMAX (mmHg)
- ETP (%)
- FT (ms)
- FT (ms)

Unique:
USCM’s non invasive method is unique. Previously, valuable haemodynamic information was only available through invasive means – rarely suitable for children, and decreasingly used in adults. USCM is validated across a wide range of cardiac outputs in neonates, infants, children and adults.
USCOM is the only truly accurate, Non invasive system

PETER R. LICHTENTHAL, M.D.
Professor and Director of Cardiovascular Anesthesia, University of Arizona College of Medicine

Proven Non Invasive Method

To calculate left cardiac output using the USCOM Ultrasonic haemodynamic monitor, a small, non invasive Doppler probe is placed in the suprasternal notch aiming directly down the longitudinal axis of the ascending aorta and across the aortic valve. Pulmonary or right sided cardiac output is evaluated the same way via the pulmonary valve using the parasternal approach.

Left Approach

Right Approach

Using USCOM’s beam acoustics technology, the probe emits a broad, continuous wave Doppler ultrasound signal which is used to calculate the ejection velocity of blood as it exits the aortic and pulmonary valve. The real time FlowTracer provides quantitative, beat to beat haemodynamic information.

The USCOM monitor has been proven at five stages of validation. Historical evidence shows the accuracy and reliability of continuous wave Doppler. Independent in-vitro testing, animal studies and clinical trials in humans which compared the USCOM to Flow probes, Fick and the clinical “gold standard” Pulmonary Artery Catheter (PAC), clearly demonstrate the accuracy of the USCOM monitor in measuring blood flow. More and more evidence is presented at scientific meetings that confirm its usefulness in clinical practice.

Under precision flow probe testing, the USCOM device exactly agreed with measured flow velocities from -1 to 1.6 metres per second, the accurate range of the simulator.

MecaBio - Ecole Superieure de Mecanique de Marseille, I.M.T.- Technople de Chateau Gombert, Marseille, France.

"USCOM is a reliable method of measuring CO in critically ill patients. The non invasive USCOM provided adequate data to distinguish different shock types in ICU patients.”

L.E.M. HAAS
Dept of ICU, Gelderse Vallei Hospital, Ede, The Netherlands

"These results suggest that USCOM is as accurate for measurement of neonatal CO as conventional echo and may be more sensitive for detection of haemodynamic change.”

R. PHILLIPS
University of Queensland, Brisbane, Australia

"The haemodynamic patterns of fluid-resistant septic shock on presentation are distinct depending on etiology. The consistency of this finding suggests that cardiovascular responses to severe sepsis are determined more by the immediate clinical scenario than by gene.”

DR. J. BRIERLEY
PICU, Great Ormond St Hospital, London, UK

"Scatterplot of mean CO values from standard methods against USCOM demonstrating good linear agreement of values with no outstanding disagreement associated with any particular method.”

P. LICHTENTHAL
Anesthesiology, University of Arizona, Tucson, Arizona, USA
## Technical specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>USCOM 1A</th>
</tr>
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<tbody>
<tr>
<td>Technology</td>
<td>Continuous Wave Doppler</td>
</tr>
<tr>
<td>Display</td>
<td>12.1” TFT LCD (800x600)</td>
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<tr>
<td>Interface</td>
<td>Resistive Touch screen</td>
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<tr>
<td>CPU</td>
<td>X86 compatible</td>
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<tr>
<td>Operating System</td>
<td>Windows CE.NET</td>
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<tr>
<td>Storage</td>
<td>More than 500,000 exams</td>
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<tr>
<td>Transducer Frequency</td>
<td>2.2MHz</td>
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<tr>
<td>Transducer Size</td>
<td>12mm diameter</td>
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<tr>
<td>Doppler FlowTracer</td>
<td>Fully automated</td>
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<td>Battery</td>
<td>2 hour life with fast-charge</td>
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<tr>
<td>Power Supply</td>
<td>Universal voltage with medical isolation</td>
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<tr>
<td>Dimensions</td>
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<tr>
<td>Weight</td>
<td>5kg / 11 pounds</td>
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<tr>
<td>Construction</td>
<td>Molded plastic with metal chassis</td>
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<tr>
<td>GUI</td>
<td>Web based protocols</td>
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<tr>
<td>Communications Ports</td>
<td>Serial, USB, Ethernet</td>
</tr>
<tr>
<td>User Interface</td>
<td>Multi language</td>
</tr>
</tbody>
</table>

“This machine is saving lives”

Associate Professor BRENDAN SMITH  
Charles Sturt University of Biomedical Sciences, Bathurst Base Hospital