Impedance Cardiography

Measuring a patient’s haemodynamic status safely, non-invasively and reliably

Fast assessment of haemodynamic status and the circulation’s capacity to deliver oxygen and nutrients to the vital organs has always been of central importance in emergency medicine. Reliable information is often critical to both diagnosis and guiding treatment. Traditionally, the choice has been between intermittent measurements, such as thermocoupling or Doppler echocardiography, or piecing together the clues given by blood pressure, heart rate, respiratory rate and pulse oximetry. However, using Thoracic Electrical Bio-impedance (TEB), the emergency doctor can determine cardiac output continuously along with a host of other haemodynamic parameters. And best of all, the measurement is both inexpensive and non-invasive.

NASA first developed TEB in the 1960s to monitor haemodynamic changes in astronauts. Four small sensors send and receive a low-amplitude, high frequency current through the patient’s thorax. The signal and the resultant present constant, high impedances. So the variations in the fluid in the thoracic cavity – the plasma of the heart and the great vessels – cause most of the changes of thoracic impedance. Because they traverse the thoracic cavity, the aorta and vena cava act as the path for most of the current. Therefore, the biggest changes in current tell us about the variations in the volume and speed of aortic blood, produced by the pumping action of the heart.

The timing of the changes can be directly related to the systolic time intervals. This makes it possible to measure such factors as the ventricular ejection time (VET) and the pre-ejection period (PEP). The variation in the rate of the change makes it possible to determine the contractility of the heart.

And the size of the changes is directly related to the stroke volume (SV). This can be used as a basis for further, important values. Multiplying SV by the heart rate, and taking the patient’s height, weight, age and gender into consideration provides a reliable, continuous estimation of cardiac output. This in turn can be used to calculate total peripheral resistance, aortic compliance and further haemodynamic parameters.

Uncomplicated measurement

Philips Impedance Cardiography (ICG) uses just four sensors – each with one electrode for sending and receiving the signal and one electrode for measuring the impedance. Two sensors are placed on the neck above the clavicle and level with the sternal notch, and two are placed on either side of the thorax, with the xyphoid process and in line with the midaxillary line. The clear positioning makes an important contribution to the accuracy of the measurement.

A sophisticated algorithm turns the TEB signal from these sensors into a waveform without pacemaker spikes and respiratory artefacts. The algorithm adjusts the timing of the operator.

The algorithm adjusts for patient gender, height, weight and age, and applies adaptive averaging and beat filtering to remove noise and ensure curves that are typical for the patient. Finally, it calculates 12 parameters, including thoracic fluid content, accelerated cardiac index, stroke volume, cardiac output and systemic vascular resistance, for a comprehensive assessment of the patient’s haemodynamic status.

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The new Philips HD11 XE is a compact and elegantly designed “all-in-one” system that puts a wide range of necessary tools – diagnosis, assessment, procedure guidance, and monitoring – all at clinicians’ fingertips. It is designed to work with a broad range of transducers – more than 20 – allowing clinicians to select the transducer that best fits their patient without having to change systems.

The new HD11 XE (extreme edition) adds a variety of features to help physicians more accurately measure heart chambers, wall motion and ejection fraction. Features like a flat panel monitor; improved ergonomics and more powerful cardiac capabilities help physicians streamline workflow. Whether used on-cart or off-line, the system’s QLAB quantification software helps physicians improve their diagnostic capability by providing an extensive, non-invasive assessment of cardiac anatomy and function.

3D Roadmapping

The advanced capabilities of the Philips Allura Xper system are utilized in integrated 3D Roadmapping. This Philips-exclusive technology enables physicians to see a 3D view of target vessels superimposed on live 2D images, allowing for accurate live 3D catheter navigation, facilitating interventional treatment during very complex cases. An in-room monitor shows the 3D Roadmap while in parallel an X-ray monitor displays live fluoroscopy. The key advantage is the sustainable 3D Roadmap, which automatically follows a change in the system’s viewing angle or magnification. The new tool enables catheterization even in complex morphological structures due to the ability to follow the catheter in 3D in real-time, allowing the physician to get an accurate view of the catheter tip without additional contrast injections.

Introducing lung mechanics monitoring

The new Philips Spirometry module provides continuous real-time and trended measurements of lung mechanics on IntelliVue patient monitor displays. Continuous spirometry can contribute to better management of patients on ventilators, with the goal of reducing ventilator-associated complications and dependence.

Delivering Easier to Use Systems with Higher Quality Images

The newest version of the HD11 ultrasound system, the Philips HD11 XE, is a compact and elegantly designed “all-in-one” system that puts a wide range of necessary tools – diagnosis, assessment, procedure guidance, and monitoring – all at clinicians’ fingertips. It is designed to work with a broad range of transducers – more than 20 – allowing clinicians to select the transducer that best fits their patient without having to change systems.

3D Roadmapping can be of great value and can facilitate, for example, the deployment of coils in a cerebral aneurysm. Viewing the anatomy in three planes, interventional radiologists can make the right decision at the right time.
CT HALO

Patient-centric design element of the Ambient Experience. New exam room environment leapfrogs the decades old layout of separate scan and control rooms into a new, more efficient and comfortable design. Customers will soon wonder why they tolerated spending extra minutes walking in, out and around the control room, to initiate an exam that takes less than ten seconds. In conjunction with research performed with Ambient Experience, CT Halo gives caregivers time to focus on their patients by decreasing procedure room and more closely monitor the patient. CT Halo is a breakthrough in throughput and efficiency for Radiology, Cardiology and Oncology CT.

XperCT

XperCT provides clinicians with high-speed CT-like imaging on Allura Xper systems, meaning that advanced soft-tissue imaging can in many cases be acquired without transporting the patient. XperCT facilitates the visualization of soft-tissue structures and low-contrast areas like tumors and bleedings. In addition, XperCT can be matched with 3D-RA imaging, enabling interventionalists to relate areas of bleedings or other soft tissue features to the vessel tree.

DigitalDiagnost Compact for cost-effective direct digital X-ray

Philips introduced a new, multi-purpose direct digital radiography system, DigitalDiagnost Compact. It is especially attractive for small hospitals as cost-effective entry into digital radiography, with all its advantages in the digital workflow. The system is based on the successful all-in-one DigitalDiagnost for multi-applications. Its centerpiece is the fixed detector column with its flexible arm that supports positioning from a great variety of angles. It is a versatile system that, combined with a trolley covers a wide range of radiographic examinations – from horizontal, vertical to lateral projections. It is the ideal system for an X-ray room with low-to-medium patient-throughput, or serves as a multi-purpose back-up DR system for your radiology department. Like all Philips digital radiography solutions, DigitalDiagnost Compact provides high-quality images with UNIQUE – the Philips-exclusive, multi-resolution image processing. UNIQUE delivers excellent detail visibility in all areas. The images are optimised for each anatomy according to your preferences. The caesium-iodine flat detector covers a large field of view (43 cm x 43 cm) that is especially beneficial for examinations for large patients.

New BV surgical mobile C-arm systems

The next generation of the Philips BV Endura and BV Pulsera Mobile C-arm systems sets new standards in mobile imaging. With the introduction of SmartVision, a highly advanced, fully digital 1Kx1K imaging chain in combination with unique state-of-the-art image processing algorithms provide high quality images at the lowest possible dose. Features include BodySmart and Automatic Shutter Positioning.

The new ultra-compact Mobile View Station fits seamlessly into the surgical workflow. The unique intelligent viewing concept of the Mobile View Station provides the user with easy transportation and system set-up as well as optimal viewing capabilities. Features include the foldable color LCD screens with 180 degree rotation and a touch screen on the left monitor. This intuitive Vequion-based interface handles all patient administration details including acquisition and reporting at the tip of a finger. The BV Pulsera systems will have optional add-on capabilities to enable 3D intra-operative imaging additional to the 2D imaging capabilities. The BV Pulsera can provide 2D image guidance during routine procedures while enabling 3D imaging support for complex procedures that need additional guidance. This new offering will allow surgeons to apply intra-operative 3D imaging originating from vascular 3D imaging to orthopedic, ENT, head, neck, trauma and extremity procedures.

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19th European Congress of Obstetrics and Gynaecology 5th – 8th April 2006 Torino, Italy


May

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CardioStim 2006 15th World Congress 14th – 17th June 2006 Nice, France

World Congress of Fetal Medicine 25th – 29th June 2006 Barcelona, Spain www.fetalmedicine.com