



NICCI Technology

Advanced Hemodynamic Monitoring
at your fingertips

This document is intended to provide information to an international audience outside of the US.

GETINGE 

Re-thinking Hemodynamic Monitoring

An increasing number of patients require precise perioperative hemodynamic insights and should be monitored according to the latest standards.¹

Hemodynamic values can be used as targets to guide perioperative hemodynamic management and to avoid postoperative complications.² NICCI enables the monitoring of dynamic blood pressure, blood flow, preload and contractility parameters in a completely noninvasive way.

Continuous, noninvasive monitoring detects critical blood pressure fluctuations and can improve perioperative care by helping to reduce hypotensive periods.³

Additionally the analysis of the arterial pressure curve makes it possible to monitor not only blood pressure but also blood flow and its determinants. NICCI can help guide treatment decisions by providing reliable numerical hemodynamic parameters, such as cardiac index, stroke volume variation and pulse pressure variation.²

NICCI provides a complete picture of the patient's individual hemodynamic status – ensuring you “never miss a beat”.

Advantages of continuous blood pressure measurement and its derived parameters^{3,4,5,6}



Continuous monitoring allows the detection of rapid blood pressure changes often missed by upper arm cuff measurements



Obtaining a full set of advanced hemodynamic parameters (e.g. CI, SVV, PPV, CPI)



Enables individualized intraoperative fluid management

Hypotension

– an unknown risk?

Nowadays, the question is not whether intraoperative hypotension is dangerous or not but rather how it can be prevented.



72%

of non-cardiac surgical patients experienced hypotension during their respective procedures.⁷



82%

of routine blood pressure monitoring during general anesthesia and surgical procedures relies on intermittent measurements.^{8,9}



40%

of hypotensive episodes during surgeries might be missed or overlooked by intermittent upper arm cuff readings.¹⁰

Complications associated with intraoperative hypotension

Hypotensive phases have a mean duration of around 3 minutes. Yet even 1 minute at a mean arterial pressure (MAP) of 50 mmHg, or accumulative effects over short periods, increases the risk of mortality by 5% and can result in organ failure or complications including:^{3,11}



7.4%

increased risk of acute kidney injury when blood pressure drops below 65 mmHg or 20% from baseline.¹²



56%

of cardiac arrests are preceded by pronounced hypotension.¹³



2.3%

of patients developed myocardial injury after non-cardiac surgery.¹²



1.3%

increased risk of a post-operative stroke for each minute of intraoperative hypotension (IOH).¹⁴



17%

of non-ambulatory patients suffer complications within 30 days following surgery.^{15,16}

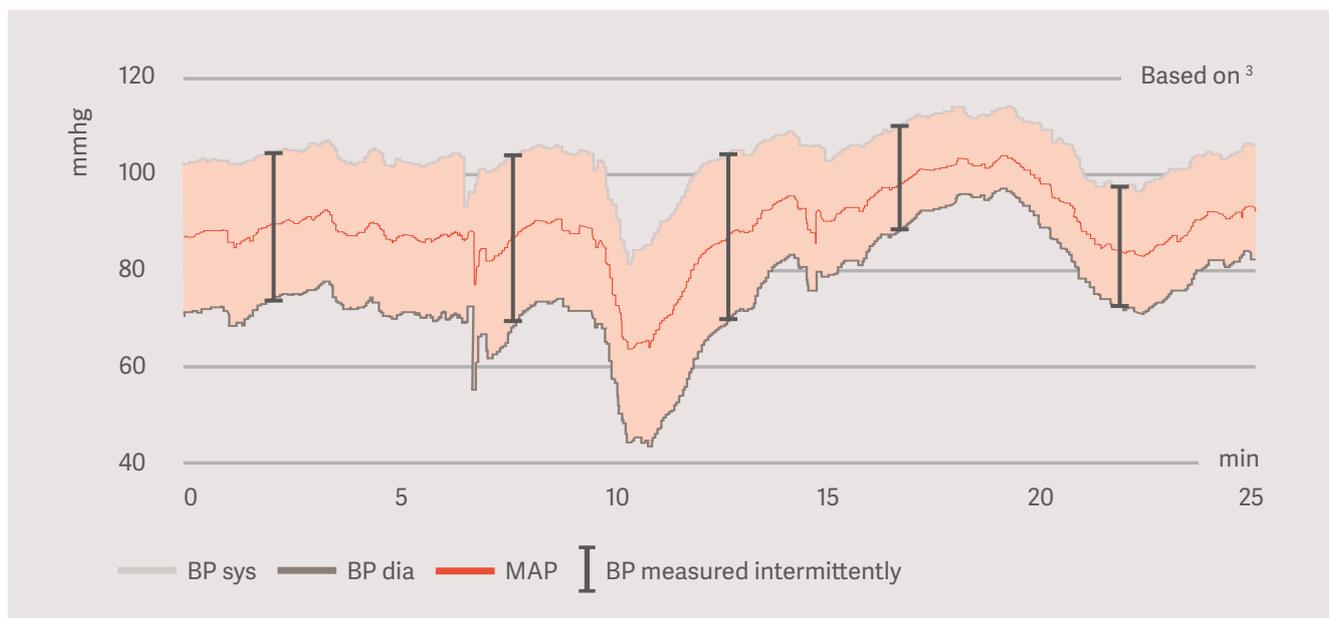
Why upgrade to continuous, noninvasive hemodynamic monitoring?

New, smart hemodynamic monitoring technologies enable a fast recognition of the actual blood pressure and may decrease the risk of hypotension-associated complications.¹⁷

Continuous noninvasive blood pressure monitoring was able to identify hypotensive periods (SAP < 100 mmHg) of

prolonged duration in 91% of patients (as compared to 55% by NIBP each 3 min).¹⁰

The use of continuous monitoring even without any dedicated protocol led to higher blood pressure stability and fewer hypotensive events.¹⁸



Noninvasive approach reduces patient discomfort and anxiety

Monitor a wide spectrum of hemodynamic parameters with improved patient compliance and less stress for the patient. Without the necessity of invasive cannulation, NICCI improves patient comfort and reduces the risk of catheter-related adverse outcomes.

Continuous hemodynamic monitoring not only allows the immediate detection of drops in blood pressure, it also helps to guide fluid administration. Obtaining advanced hemodynamic parameters like cardiac output and its determinants can be useful for optimizing individual goal-directed therapy.²

Individualized patient monitoring

In perioperative medicine, hemodynamic management aims to optimize perfusion pressure and oxygen delivery.²

Hemodynamic management triggers the administration of fluids to achieve predefined target values of hemodynamic variables. This is known as “goal-directed fluid therapy” (GDFT). Dynamic parameters such as stroke volume variation (SVV) and pulse pressure variation (PPV) are now widely recognized as important markers for the guidance of fluid management.¹ SVV and PPV assessed using continuous, noninvasive blood pressure monitoring devices are as accurate as PPV and SVV obtained invasively.¹⁹

Reducing risk & improving outcome through individualized goal-directed therapy²⁰

- Noninvasive NICCI PPV/SVV is an accurate predictor of fluid responsiveness in anesthetized patients.*^{19,21,22}
- Goal directed therapy with NICCI significantly reduces postoperative infections, organ complications and number of transfusions.*²³
- Noninvasive CO with NICCI performs comparably to invasive CO monitoring.*²⁴
- The time to extubation, the length of stay in the intensive care unit, and the lactate level 6 h after surgery were significantly lower in the GDT group.^{25,26}
- GDT is associated with a reduction in the rate of intensive care unit admission and an improvement in immediate postoperative outcome in patients.²⁶



* The studies mentioned have been performed with the CNAP System. Getinge integrated the technology and algorithm into the PulsioFlex platform. Based on bench tests the NICCI system equals in performance and accuracy the CNAP System so that the clinical results can be used equally.

The first real hands-on solution

Unique application concept

NICCI provides the advantage of continuous monitoring when an arterial line is not indicated but intermittent blood pressure measurement is not sufficient.

NICCI is the latest innovation in Advanced Hemodynamic Monitoring providing continuous and noninvasive parameters during surgery. Now a broader range of patients in the OR can benefit from advanced hemodynamic insights. NICCI monitors the patients' hemodynamic status even before induction of anesthesia and after surgery. Therefore, an application for pre-and perioperative optimization as well as postoperative rehabilitation is useful.



reddot winner 2020



NICCI Sensor in three sizes

- Comfortable fit – Ergonomically designed to fit on left/right, index/middle or middle/ring finger
- Dual Cuff Sensor – Automatically alternating finger cuffs for improved patient safety
- Three available sizes – Because every patient is different, we designed sensors that fit most patients' hand size and shape (excluding children under the age of four)



NICCI Mouse

- Compact mouse design fits into patients' palm
- Built-in finger size measurement tool – Determination of correct sensor size where you need it
- Easy to clean and store – Ergonomic design for a quick setup
- Easy click and plug mechanism – User-friendly and quick setup



NICCI Module

- Quick access keys - To start/stop measurement or trigger an upper arm cuff (NIBP) measurement
- Integrated Cable & Mouse Storage
- Integrated NIBP Module – Automatic calibration to the standard
- Expands PulsioFlex Monitor with NICCI Technology



PulsioFlex Monitoring Platform

- One monitor for all technology applications (NICCI, ProAQT, PiCCO, CeVOX, LiMON)
- Established PulsioFlex user interface
- Familiar PulsioFlex visual highlights like dynamic „Spider“ feature
- Compact design of the PulsioFlex unit provides small footprint in the OR

NICCI Parameters

Blood pressure and its derived parameters

Based on Pulse Contour Analysis, NICCI provides valuable information about the blood flow, preload, afterload and contractility.

Continuous Parameters provided by NICCI:



Blood Pressure



Blood Flow

AP_{sys}
Systolic
Arterial
Pressure

AP_{dia}
Diastolic
Arterial
Pressure

MAP
Mean
arterial
pressure

CI
Cardiac
Index

SVI
Stroke
Volume
Index

To calibrate the curve to the gold standard, NICCI performs calibrations to the upper arm cuff on a regular basis.



Preload



Afterload



Contractility

SVV
Stroke
Volume
Variation

PPV
Pulse
Pressure
Variation

SVRI
Systemic Vascular
Resistance Index

dPmx
Left
Ventricular
Contractility

CPI
Cardiac
Power
Index

NICCI can for example be used in the following areas:



Operation Room (OR)



Emergency Room (ER)



Post-Operative Care Unit



Cath-Lab

NICCI Technology

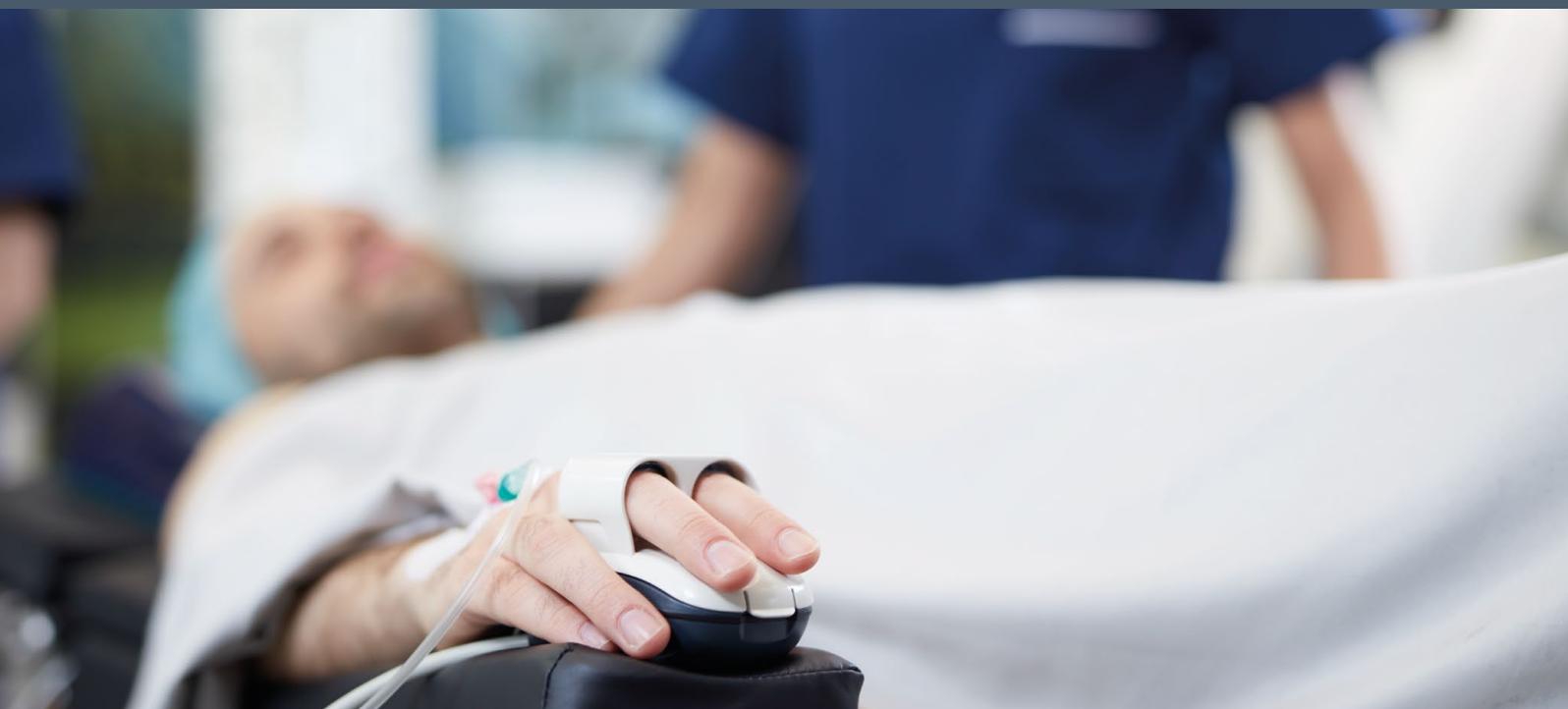
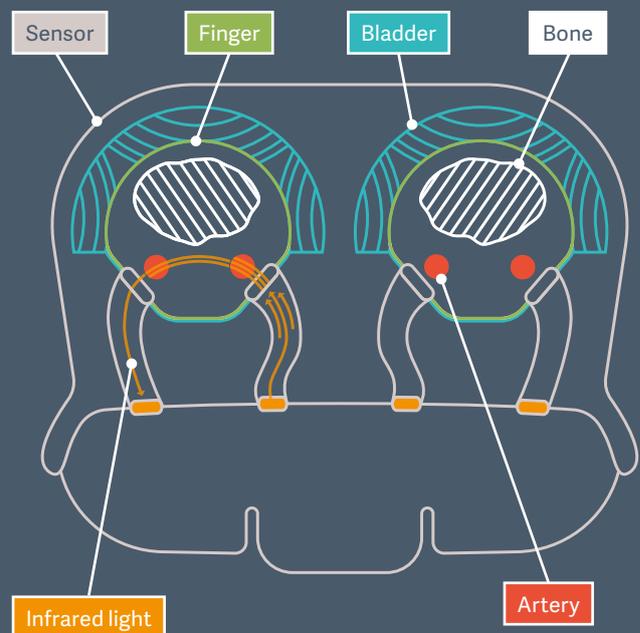
Embracing 20 years of intelligence

The NICCI Technology is based on CNAP's continuous noninvasive blood pressure technology "Vascular Unloading Technique".

Infrared light is used to track the volume and flow of the blood in the finger arteries. The NICCI system holds the blood flow and volume constant over time by continuously inflating and deflating the integrated bladders of the finger sensor. This methodology is known as Vascular Unloading Technique.

Proven accuracy in clinical settings

- CNAP/NICCI measurements are comparable to invasive arterial line measurements in terms of continuity, accuracy and waveform dynamics.^{4, 27, 28}
- CNAP/NICCI provides immediate hemodynamic status and detects drops in blood pressure during the induction of anesthesia.²⁹



Advanced patient monitoring platform

The PulsioFlex Monitoring Platform combines different technologies.

You can easily extend the hemodynamic scope with modules featuring NICCI, ProAQT, PiCCO, CeVOX, and LiMON. This will give you the information you need to help assess the hemodynamic status for a broad range of patients.

The following table lists the parameters available with the current technologies:



	NICCI	ProAQT	PiCCO	CeVOX	LiMON
Invasiveness	Noninvasive	Minimally invasive arterial line	Less invasive arterial catheter	Less invasive	Noninvasive
Pulse contour analysis (continuous)					
Chronotropy	PR	HR	HR		
Blood Pressure	AP _{sys} , AP _{dia} , MAP	AP _{sys} , AP _{dia} , MAP	AP _{sys} , AP _{dia} , MAP		
Flow	CI _{Trend/Cal} **, SVI	CI _{Trend/Cal} **, SVI	CI _{PC} *, SVI		
Contractility	dPmx, CPI	dPmx, CPI	dPmx, CPI		
Afterload	SVRI	SVRI	SVRI		
Volume responsiveness	SVV, PPV	SVV, PPV	SVV, PPV		
Thermodilution (discontinuous)					
Flow			CI _{TD} ***		
Preload			GEDI, ITBI		
Contractility			CFI, GEF		
Pulmonary edema			ELWI, PVPI		
Oxymetry					
Oxygen saturation				ScvO ₂	
ICG elimination					
Liver function					PDR, R15
Besides the PulsioFlex, the Advanced Patient Monitoring Technologies are integrated into the following OEM platforms:					
	Nihon Kohden	Philips, Mindray, Dräger Medical, General Electric, Nihon Kohden	Philips, Mindray, Nihon Kohden		

* Cardiac index derived from pulse contour ** Calibrated from internal or external reference value *** Cardiac index derived from thermodilution

Passion for life

Improving outcomes for critically ill patients



Advanced hemodynamic monitoring helps physicians understand complex conditions of patients in intensive care units and during high-risk surgeries and helps to optimize their hemodynamic condition.²⁰

Pulsion's core competence is the development and production of medical devices for monitoring critically ill patients. Pulsion Medical Systems SE was founded in 1990 and is located in Feldkirchen, Greater Munich. Since 2014, Pulsion is wholly-owned by, and fully-integrated with Getinge.

Getinge is a global provider of innovative solutions for operating rooms, intensive care units, sterilization departments and life science companies and institutions.

Based on our firsthand experience and close partnerships with clinical experts, healthcare professionals and medtech specialists, we are improving everyday life for people – today and tomorrow.



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