VER
Vascular & Endovascular Review

New Method for Continuous Real-time Assessment of Local Blood Oxygenation

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ABSTRACT

A novel intravascular blood oxygenation sensing wire has been developed to facilitate continuous, real-time measurement of local blood oxygenation during endovascular interventions. Its performance was evaluated by comparison with intermittent arterial blood gas sampling and continuous pulse oximetry. This study reports preliminary in-vivo results obtained from three porcine models, in which the monitoring modalities were employed concurrently. The comparative assessment was conducted under two distinct physiological conditions: (1) unobstructed vascular flow, and (2) obstructed flow conditions, induced by balloon-catheter occlusion of a targeted vascular segment. Initial findings demonstrate that the oxygenation sensing wire provides continuous and localized intravascular oxygenation assessment. During unobstructed flow, its measurements exhibit strong concordance with systemic arterial blood gas and pulse oximetry readings. Under flow obstruction conditions, the sensing wire's readings diverge from systemic pulse oximetry owing to its unique capability to directly measure local oxygenation distal to vascular occlusions, which is an assessment not achievable with traditional arterial blood gas or pulse oximetry techniques.

KEYWORDS: Diffuse reflectance spectroscopy, blood oxygenation, oxygen saturation, PO, SpO2, SaO2, SO2, ABG, endovascular, in-vivo, iBLOS.

How to Cite: John Racadio, Gerald Lucassen, Manfred Mueller, Ross Schierling, Judy Racadio, Draženko Babić, (2025) New Method for Continuous Real-time Assessment of Local Blood Oxygenation, Vascular and Endovascular Review, Vol.8, No.3, 171-180

INTRODUCTION

Blood oxygenation adapts to meet the metabolic requirements of local tissues, mainly via physiological processes such as enhanced local oxygen extraction and modulations in blood flow. Despite these regional adjustments, arterial blood oxygenation at the systemic level remains relatively stable under normal physiological conditions, primarily owing to robust cardiovascular and respiratory regulatory mechanisms. Intravascular thrombus formation, however, may result in partial or complete occlusion of the affected vessel, thereby reducing the downstream delivery of oxygen and essential nutrients to the dependent tissue. The degree of resultant ischemia is influenced by factors such as the adequacy of collateral circulation and the metabolic activity of the distal tissue, with potential clinical sequelae ranging from transient hypoxia to irreversible infarction.

Currently, two fundamentally different methods are used to measure systemic blood oxygenation: arterial blood gas (ABG) analysis and pulse oximetry (PO). ABG is considered the gold standard for assessing arterial oxygenation1,2 and plays a vital role in diagnosis and treatment planning. However, ABG measurement requires periodic arterial blood sampling at specific intervals, resulting in discontinuous blood gas monitoring and susceptibility to various errors, including issues related to sampling techniques, transport delays, air contamination, and sample dilution3. Since ABGs provide only a single-point measurement of blood oxygenation, clinicians must carefully time sample collection for optimal clinical insights. Additionally, the iSTAT point-of-care blood analyzer (which was used in this study for ABG analysis) has reduced accuracy at oxygen saturation (SO2) levels below 85%4.

PO was developed as a continuous, non-invasive alternative to track peripheral oxygen saturation (SpO2) trends and facilitate rapid clinical decision making. It operates using photo-plethysmography (PPG) to measure a global tissue average of oxygen saturation. PO is a real-time, painless, widely available, and cost-effective method, making it a standard tool in intensive care, surgery, and outpatient settings. PO has been shown to yield accurate oxygen saturation readings when the arterial oxygen saturation (SaO2) exceeds 90%, serving as a reliable alternative to ABG in such conditions. However, its accuracy declines in hypoxemic conditions (SaO2 < 85%), limiting its effectiveness in critical cases5.

The intravascular Blood Oxygenation Sensing (iBLOS) system employs optical spectroscopy to measure blood oxygenation. The iBLOS wire is introduced into arterial circulation via a catheter and microcatheter and navigated to the site of vascular obstruction or beyond. The guidewire was advanced through the vascular occlusion, followed by the microcatheter. The guidewire was then exchanged for a sensing wire, which was advanced to the distal end of the microcatheter. Subsequently, the microcatheter was slightly retracted, leaving the sensing wire tip within the vascular lumen. Oxygenation measurement was performed in real time, after which the sensing wire was exchanged for a standard guidewire. This technology is envisioned to produce accurate real-time endovascular blood oxygenation readings during life-threatening acute intravascular procedures (e.g., mechanical thrombectomy in acute ischemic stroke or coronary stenting in acute myocardial infarction). In contrast to both ABG and PO measurements, the iBLOS system can continuously measure blood oxygenation in segmental arterial locations, including distal to vascular occlusions.

This study aimed to evaluate intravascular blood oxygenation measurements using the novel sensing wire technology in comparison to ABG and PO. The study was conducted in two phases: (1) an in vitro validation phase, where the iBLOS wire was calibrated against ABG technology, and (2) an in vivo phase, where the iBLOS wire was validated in an animal model against both ABG and PO under conditions of unobstructed blood flow and against PO in cases of obstructed blood flow.

METHODS

Intravascular Blood Oxygenation Sensing Wire and System

The iBLOS wire has an integrated optical fiber and is based on diffuse reflectance spectroscopy technology (Figure 1). White light is delivered into the blood via an optical fiber and reflected light is collected into the same optical fiber. The spectrum of intensity of the collected light versus the light wavelength typically shows characteristic dependencies of optical scattering and absorption on molecular composition. The measured spectra of oxygenated and deoxygenated blood display different characteristic absorption peaks. The blood oxygenation value is estimated through a fit of an optical model containing the absorption and scattering properties of tissue and blood components to the measured diffuse reflectance spectrum6,7.

The iBLOS wire (Figure 2) was co-developed with Integer (Galway, Ireland). A 100µm core optical fiber is integrated in a hollow 0.014” hypotube. The distal end of the sensing wire is surrounded by a radiopaque coil and has an atraumatic tip. The proximal end of the sensing wire has an SMA905

optical connector for connecting to the light source and spectrometer using a bifurcated fiber bundle. In the iBLOS sensing wire system, a Halogen bulb emitting broadband light source (Avalight HAL-S, Avantes, The Netherlands) uses one branch of the bifurcated fiber bundle (BFY105HS02, Thorlabs, USA) to deliver white light into the blood vessel (Figure 3).

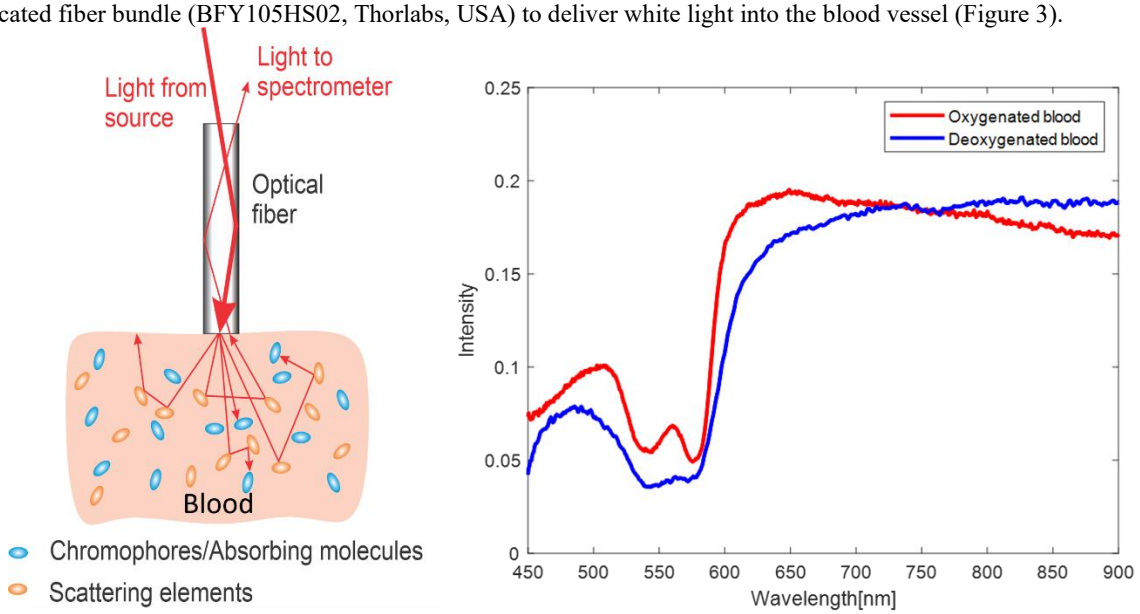

Figure 1. The fundamental operating principle of diffuse reflectance spectroscopy:
(a) White light is transmitted to the blood through an optical fiber, and the scattered light reflected from the sample is collected by the same fiber and analyzed by a spectrometer.
(b) Example spectra showing the characteristic differences between oxygenated and deoxygenated blood.

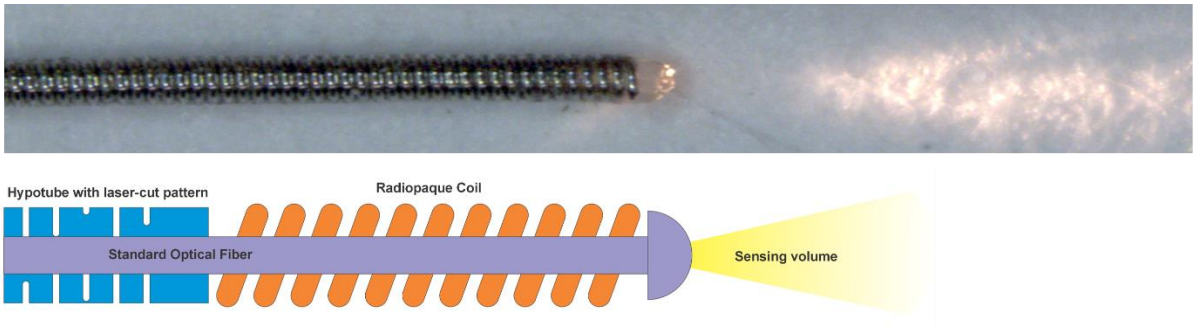

Figure 2. Image of the 0.014” endovascular iBLOS wire, featuring an atraumatic tip. A schematic diagram is shown below.

A small part of the diffusely reflected light from the blood is captured into the sensing wire and fed back to a spectrometer (Ocean Optics Maya2000Pro) via the other branch of the fiber bundle. The detected spectral intensities over the 400-1100nm (visible and near-infrared) spectral range are processed on a personal computer. Spectra are recorded with measurement sets consisting of 30 averages of individual spectra with 20ms acquisition time with a delay of 0.5 second between the measurement sets.

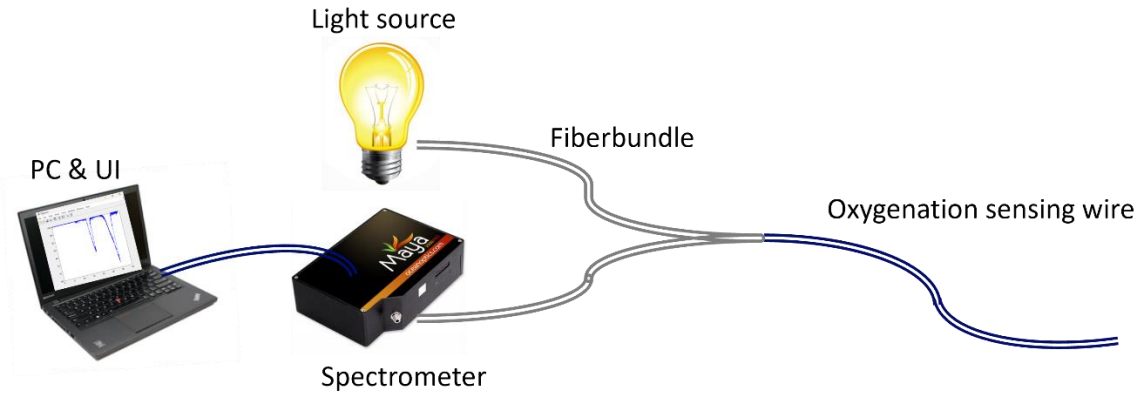

Figure 3. Diagram illustrating the iBLOS wire configuration.

In Vitro System Calibration

The iBLOS wire was calibrated in vitro using a closed artificial vascular circuit (Figure 4). This circuit consisted of a roller pump, silicone tubing, a vascular reservoir, inflow ports for compressed air and nitrogen gases, and a three-way Luer stopcock for blood sample collection. The reservoir was filled with 1 liter of citrated pig's blood, which was prepared using a 3.2% sodium citrate solution (900ml blood and 100ml sodium citrate solution). A magnetically driven stirrer ensured continuous circulation of blood within the reservoir.

Ground truth (ABG) measurements of blood oxygenation were performed with a handheld i-STAT 1 blood analyzer system8 (Abbott, Chicago/USA), using CG4+ cartridges for blood analysis. 95µl of blood was pipetted and inserted into the cartridge. The i-STAT device processed the blood sample and reported blood oxygenation as a percentage. An attempt was made to use pulse oximetry as a ground truth measurement of blood oxygenation in the same blood circulation set-up. However, the PO sensor response signals did not allow reliable readings due to a mismatch between the available roller pump pulsation frequencies and the optical characteristics of silicone tubing in the artificial circuit and the normal PO system settings with a sensor designed for measurements in living tissue.

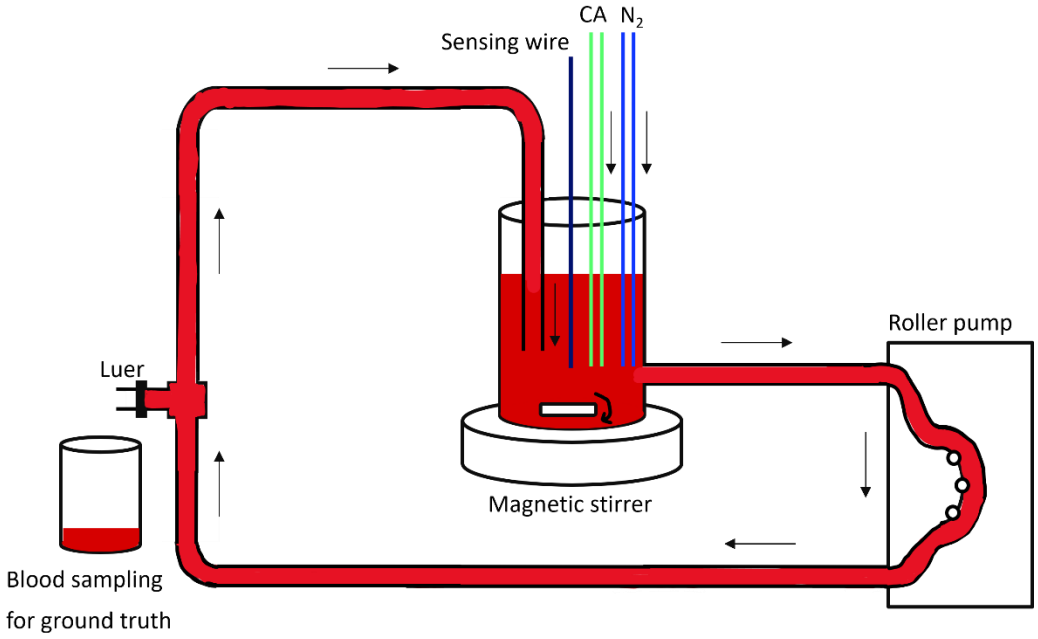

Figure 4. Bench-top in vitro blood circulation system for SO_2 calibration, using a roller pump. Blood oxygenation levels are adjusted by introducing compressed air and nitrogen gas (CA: compressed air; N_2: nitrogen gas).

The iBLOS wire was submerged in the blood reservoir, allowing for continuous oxygenation measurements. Blood oxygenation levels were modulated by insufflating compressed air (CA) to increase saturation from 30% to 100% and nitrogen gas (N2) to reduce saturation from 100% to 60%. Simulated blood sampling was performed at regular intervals by withdrawing blood through the stopcock. Blood oxygen saturation values in the iBLOS system were derived by fitting spectra measurements using a modified optical model based on Farrell7 and were compared to concurrent ABG measurements.

ANIMAL MODEL

Animal Preparation

The experimental study was conducted at the Interventional Radiology Translational Research and Simulation Lab at Cincinnati Children's Hospital Medical Center (Cincinnati/USA) in compliance with institutional guidelines for animal research and was approved by the Institutional Animal Care and Use Committee (protocol number: 000492- IACUC2025-0018). Three female juvenile Yorkshire Cross pigs (Sus scrofa domesticus), weighing between 35 and 52 kg, were used as animal models. General anesthesia was induced with an intravenous injection of ketamine (20 mg/kg, Covetrus North America, Dublin, OH) and xylazine (2 mg/kg, Dechra Veterinary Products, Overland Park, KS) and maintained with isoflurane (2-2.2%, Covetrus North America, Dublin, OH) and oxygen (100% FiO2 at 1-2 L/min). The pigs were endotracheally intubated and connected to mechanical ventilation. Initial ventilation rate was set at 16 breaths/minute with a tidal volume of 10 ml/kg. A pulse oximeter (Smiths Medical, Surgivet Advisor tech, USA) was placed on the pig's tongue for continuous monitoring of oxygen saturation. The pulse oximeter had a fixed setting to an averaging time of 8 seconds during the experiments.

Animal Experimental Work

Vascular access for introducing endovascular devices was established at three anatomical sites: bilateral common femoral arteries and the left common carotid. All punctures were performed using Seldinger technique under ultrasound guidance. These access points were utilized for either inserting endovascular devices, including oxygenation wires, or for angiographic confirmation of device placement and proper balloon catheter inflation. Arterial cannulation was performed using a 5Fr Micropuncture Introducer Set (Cook Medical, Bloomington, USA) for all access sites, followed by placement of a 5Fr Avanti+ Introducer Sheath (Cordis, Cashel, Ireland) for the femoral artery and a 6Fr for the carotid artery. To perform angiography and to navigate to the anatomical locations, a 5Fr Pigtail Catheter (Merit Medical, South Jordan, USA), a 5 Fr Soft-Vu Kumpe catheter (Angiodynamics, Latham, New York, USA) and a 0.035" Radiofocus Glidewire Guidewire (Terumo, Somerset, USA) were employed.

The animal model experiments were conducted in two phases. The first phase was designed for validation of the iBLOS system by measuring blood oxygenation and comparing results using the iBLOS wire, ABGs, and PO in the setting of an unobstructed aorta. In these cases, a 5Fr Soft-Vu Straight angiography catheter (Angiodynamics, Latham, New York, USA) and a 0.035" Radiofocus Glidewire Guidewire (Terumo, Somerset, USA) were advanced in tandem via the right common femoral artery access sheath, and the tip of the catheter was positioned in the abdominal aorta just below the level of the diaphragm under fluoroscopic guidance. The 0.035" guidewire was removed and the prototype 0.014" iBLOS wire was inserted through a Single Y-connector hemostasis valve (B. Braun Medical, Bethlehem, USA) which was attached to the 5Fr angiography catheter. The iBLOS wire was advanced approximately 1 cm beyond the tip of the angiography catheter (Figure 5) and provided a continuous recording of blood oxygenation. The pulse oximeter on the pig's tongue provided a simultaneous recording of peripheral blood oxygenation. Induced breath-hold events, which were achieved by removing the anesthetized pig from mechanical ventilation, were employed to produce systemic hypoxemia. At specific intermittent points related to the breath-hold event, ABG measurements were performed. At those points, 7ml of blood was withdrawn from the 5Fr catheter (via the left carotid access sheath) whose tip was positioned in the abdominal aorta near the iBLOS sensing wire and was discarded to fully eliminate the blood in the dead space of the catheter. Another 2ml was then withdrawn, from which 95µl was pipetted and inserted into the cartridge for processing on the iSTAT analyzer. The continuous readings from the iBLOS system and PO and the intermittent ABG measurements were recorded for comparison.

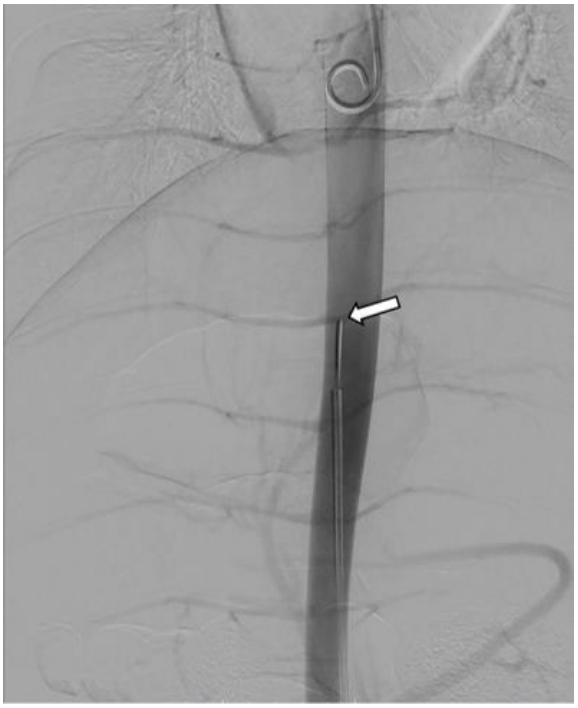

Figure 5. The tip of the iBLOS sensing wire (indicated by the arrow) is visible in the digital subtraction angiogram of the abdominal aorta.

The second phase of the in vivo experiment was designed to validate the iBLOS wire blood oxygenation results in the setting of an obstructed vessel. Three different anatomical locations (superior mesenteric artery (SMA), hepatic artery, and segmental renal artery) were chosen to reflect responses of different anatomic areas of vascular occlusion and ischemia. In each case, a Fogarty Embolectomy Catheter (5Fr for the SMA and hepatic arteries and 3Fr for the segmental renal artery) was inserted through the femoral sheath and advanced to the target vessel. The iBLOS wire was advanced co-axially through the embolectomy catheter such that the tip of the sensing wire was positioned just distal to the balloon. Positioning the iBLOS sensor distal to the occlusion site enabled continuous measurements of local blood oxygenation. The measurements were conducted before balloon inflation (unobstructed flow), during balloon inflation (stagnant obstructed flow), and after balloon deflation (re-establishment of unobstructed flow). The passing of the sensing wire through the lumen of the catheter simulated mechanical recanalization through the occlusion segment, which would need to be performed in the setting of a clinical obstruction (e.g., clot) using interventional techniques. After the balloon was inflated to occlude antegrade flow, complete arterial inflow obstruction was confirmed via endovascular iodinated contrast injection from the carotid catheter that was positioned in the abdominal aorta. Systemic oxygenation was concurrently monitored via PO. Attempts to obtain ABG measurements through the lumen of the Fogerty embolectomy catheter were unsuccessful during this phase due to technical limitations, specifically the inability to aspirate the small volume of stagnant blood distal to the occlusion back through the Fogarty catheter.

RESULTS

System Calibration

The oxygen saturation measurements acquired by the iBLOS wire and ABG in the artificial vascular circuit demonstrated excellent correlation (correlation coefficient R2=0.99) and low variability (coefficient of variation CV=3.3%, Figure 6).

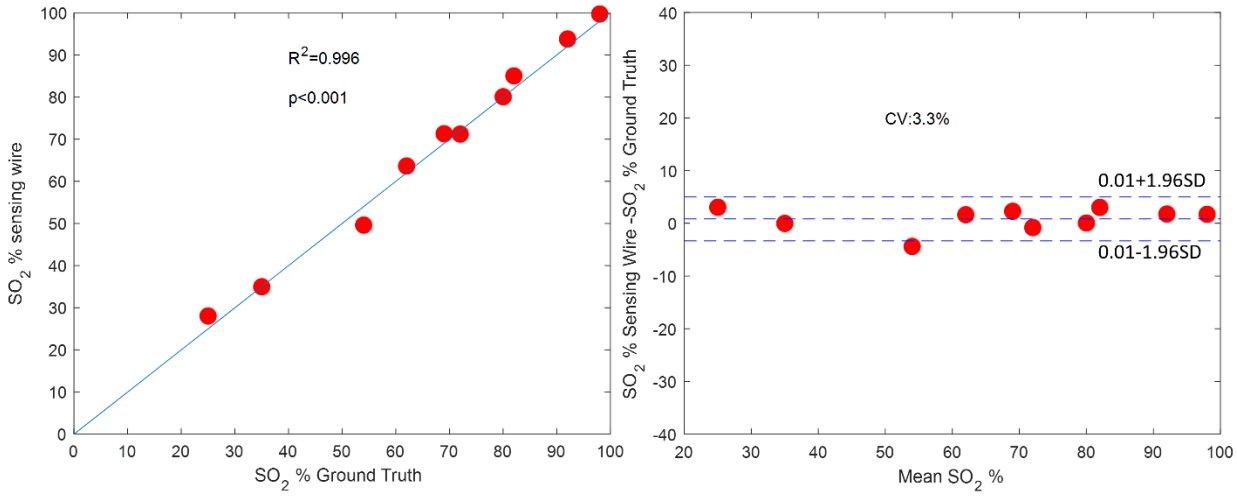

Figure 6. In vitro calibration of the iBLOS wire using the bench-top blood circulation system:
(a) iBLOS SO_2 readings are plotted against reference arterial blood gas (ABG) SO_2 values, demonstrating a high correlation coefficient (R^2 = 0.996).
(b) The Bland-Altman analysis indicates a low coefficient of variation (CV = 3.3%). Horizontal dashed lines mark the mean and the limits of agreement (mean ± 1.96 standard deviations).

OXYGENATION MEASUREMENTS IN UNOBSTRUCTED AORTIC BLOOD

Case 1: Unobstructed aortic blood flow

This data collection extended over a 45-minute acquisition period. Figure 7 demonstrates the recorded blood oxygenation values superimposed on a timeline of the 45-minute period. Controlled breath-holds were performed at the 17th and 37th minutes, each lasting approximately 120 seconds and resulting in a marked decrease in oxygen saturation, reaching levels as low as 35%. Nine intermittent arterial blood samples were collected for ABG analysis. The ABG sampling was strategically timed to be performed at baseline (samples 1, 5 and 9) and at three times during each breath-hold and subsequent reventilating to capture oxygen desaturation, nadir, and reoxygenation. Two primary observations were made: (1) PO and iBLOS recordings demonstrated close agreement throughout the entire monitoring period and demonstrated the PO recordings exhibiting a minor temporal offset; and (2) ABG measurements were largely consistent with both PO and iBLOS values during baseline, desaturation, and reoxygenation phases, but substantial deviations were observed near the lowest saturation levels.

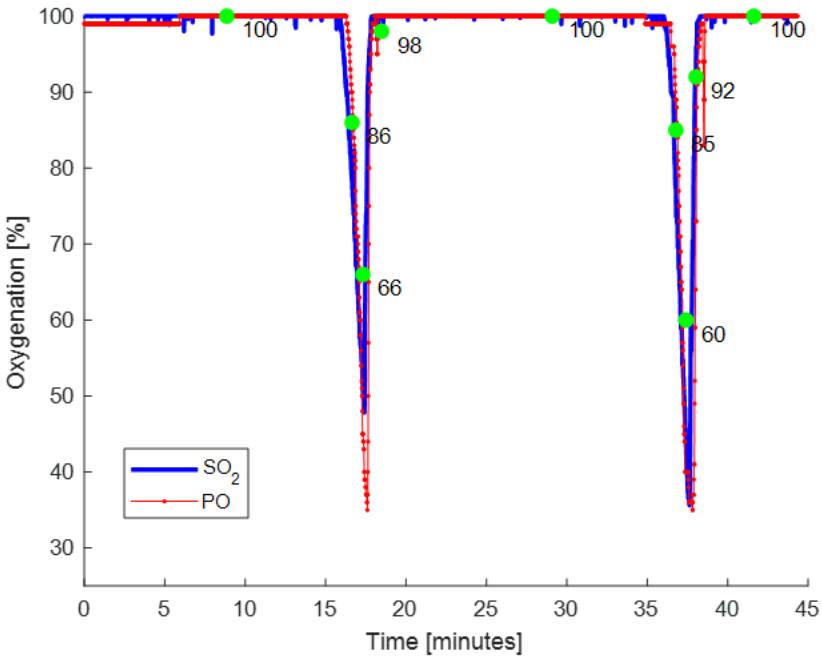

Figure 7. Blood oxygen saturation (%) in the aorta during unobstructed flow is shown before, during, and after two consecutive breath-holds, as measured by the iBLOS sensing wire (blue), PO (red), and ABG (green dots with number labels for intermittent SO_2 values). The iBLOS sensing wire results demonstrate the ability to track changes in blood oxygenation with high agreement compared to PO and ABG measurements.

OXYGENATION MEASUREMENT IN CASES OF OBSTRUCTED BLOOD FLOW

Case 2: Obstructed blood flow in superior mesenteric artery

In this case, a balloon catheter was deployed in the proximal segment of the SMA (Figure 8 a,b) to produce occlusion of antegrade blood flow to downstream colonic segments. The iBLOS wire was positioned distal to the site of occlusion and arterial inflow obstruction was confirmed with contrast injection under fluoroscopy. Data acquisition spanned 20 minutes, including a 5-minute baseline period prior to balloon inflation and a 5-minute recovery period post-deflation, during which both PO and iBLOS recorded normoxemic oxygenation levels (~100%, Figure 9). After balloon inflation there was a rapid decline in local oxygenation, eventually reaching a steady-state plateau of approximately 50% at 7 minutes after balloon inflation.

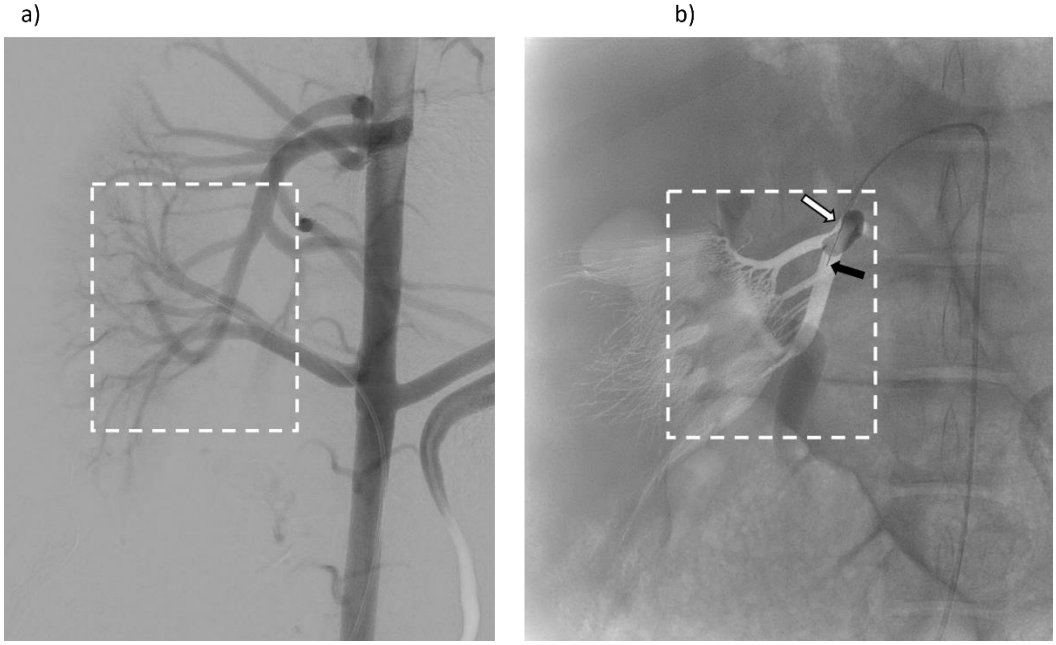

Figure 8. (a) Digital subtraction angiogram of the superior mesenteric artery (SMA). A road-map image of the outlined SMA branches in (b) shows the inflated balloon occlusion catheter (white arrow). The iBLOS wire is visualized extending from the catheter, with its tip positioned downstream of the occlusion balloon (black arrow).

This hypoxic plateau persisted for an additional 3 minutes until balloon deflation, after which oxygenation rapidly normalized within 30 seconds. The following key observations were made: (1) the iBLOS device reliably provided real-time, localized measurements of blood oxygenation distal to arterial occlusion; and (2) systemic PO readings remained at 100% throughout the experiment, failing to detect localized ischemia.

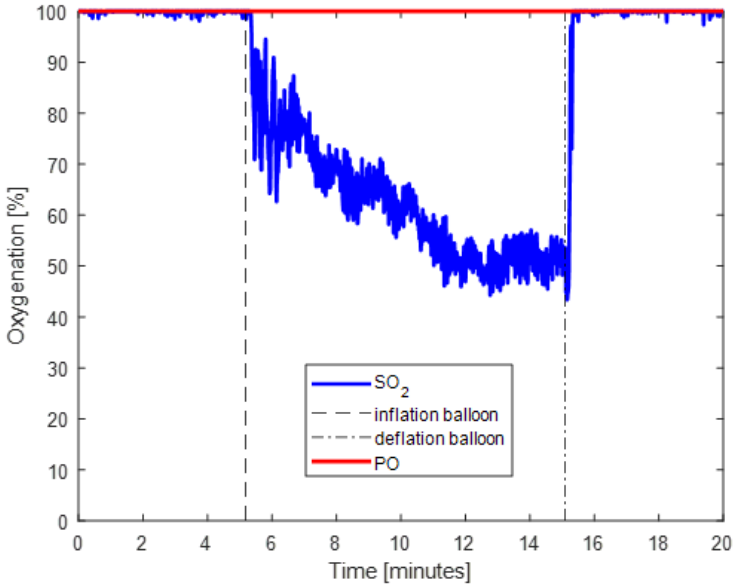

Figure 9. Blood oxygen saturation (%) in the superior mesenteric artery was measured before balloon inflation, during occlusion, and after deflation. The blue line indicates iBLOS measurements distal to the balloon, while the red line shows PO measurements. Vertical dashed lines mark the onset of balloon inflation and deflation.

Case 3 – Obstructed blood flow in hepatic artery

In this experiment, blood flow within the porcine hepatic artery was occluded using a balloon catheter (Figure 10a,b). The total recording period spanned 30 minutes, including two normoxemic steady-state phases: one prior to balloon inflation and one following deflation (each lasting approximately 6 minutes, Figure 11). Key findings include: (1) following a minor initial decline (~15%) in oxygen saturation, iBLOS readings stabilized at approximately 85% for the duration of the 18-minute occlusion period; and (2) PO measurements consistently remained at 100%. Initial angiographic assessment after balloon inflation revealed no collateral flow distal to the occlusion.

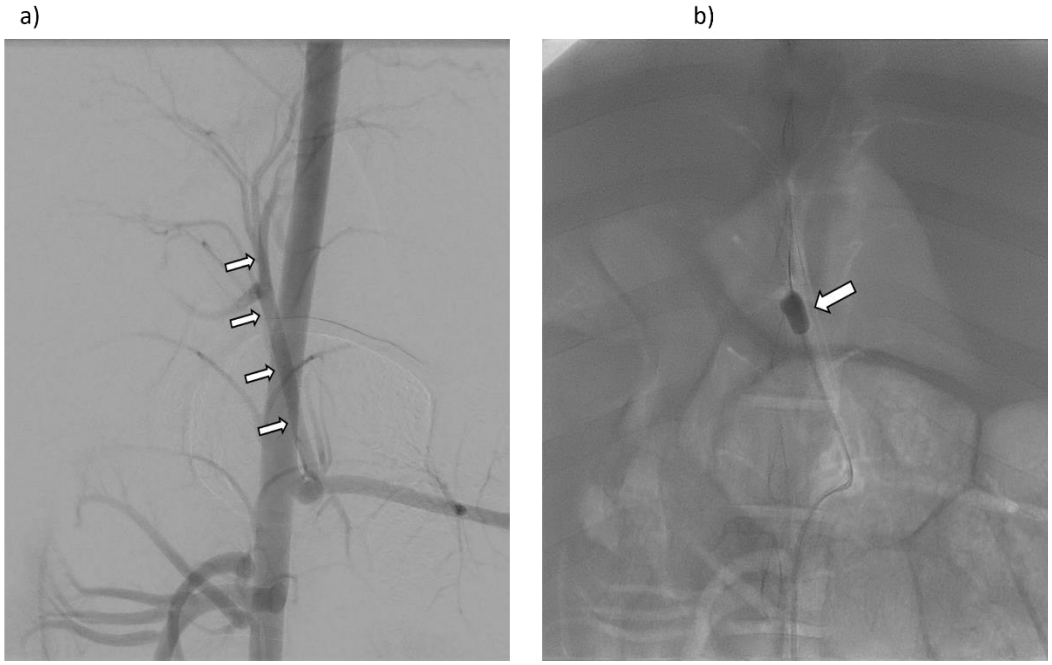

Figure 10. (a) Digital subtraction angiogram of the abdominal aorta visualizes the unobstructed hepatic artery (arrows). (b) The inflated balloon occlusion catheter is present in the proximal hepatic artery (arrow). Note that the apparent proximity of the balloon to the roadmap hepatic artery is due to a misregistration artifact caused by respiratory motion.

However, multiple re-evaluations of delayed-phase angiography revealed subtle collateral supply originating from a gastric artery branch. The injections of iodinated contrast during the execution of the study were also observed to cause a transient short-lasting disturbance in blood oxygenation readings.

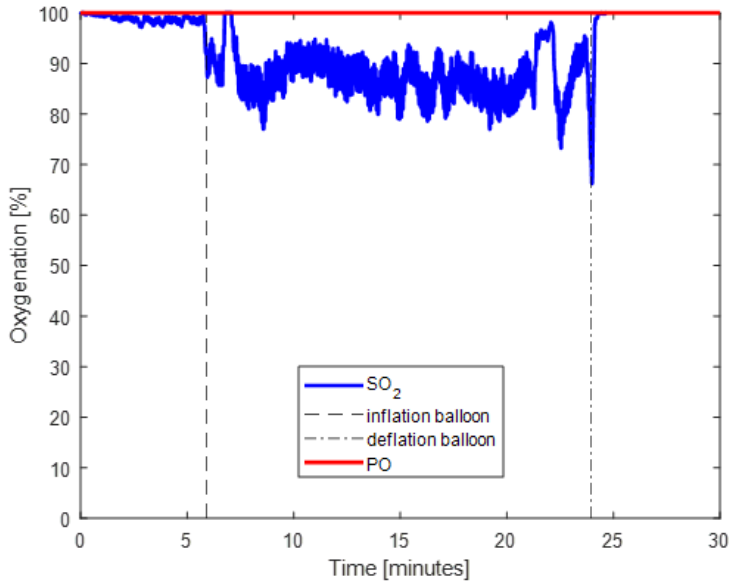

Figure 11. Blood oxygen saturation (%) in the hepatic artery was recorded before balloon inflation, during vessel occlusion, and following balloon deflation.

Case 4 – Obstructed blood flow in segmental renal artery

The right upper pole segmental renal artery was occluded and angiography confirmed a complete cessation of blood flow distal to the site of occlusion (Figure 12a,b). The measurement acquisition period lasted 25 minutes with normoxemic (pre- and post-occlusion) phases 6 minutes prior to balloon inflation and 8 minutes after blood flow was restored (Figure 13). Two key observations were made: (1) following balloon deployment, a modest decrease in oxygenation was observed distal to the occlusion site, with saturation levels falling to approximately 90%, where they remained for the duration of the occlusion; (2) peripheral oxygen saturation (by PO) remained unchanged throughout the test, maintaining a constant level of 100%.

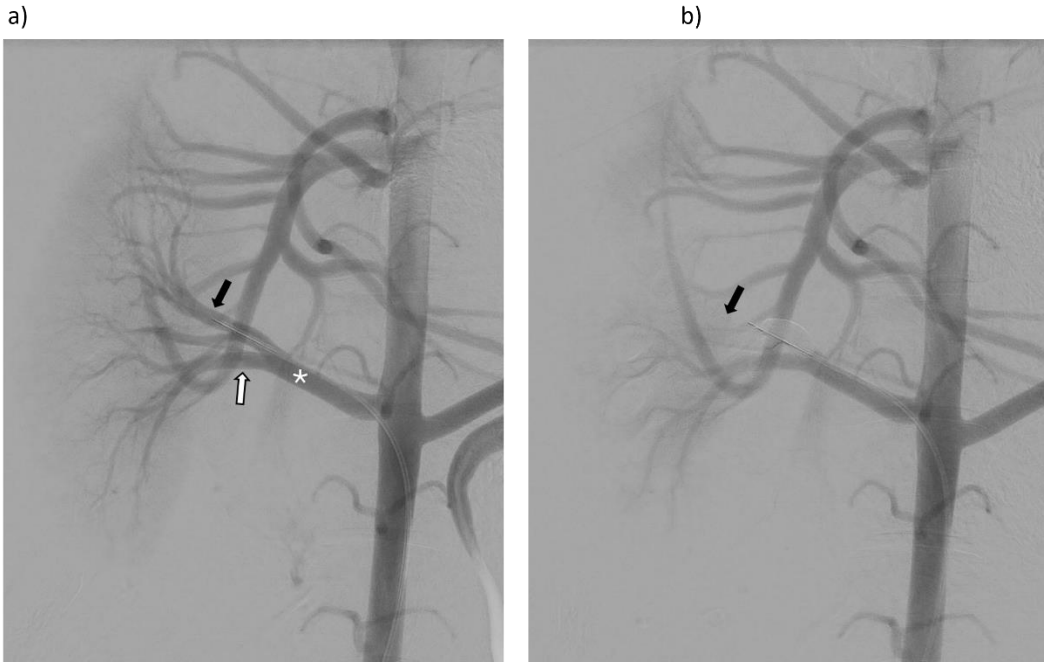

Figure 12. (a) Digital subtraction angiogram displays the unobstructed right main renal artery (asterisk), along with the upper pole (black arrow) and lower pole (white arrow) segmental branches. (b) Lack of contrast within the right upper pole branch (arrow) indicates effective balloon occlusion.

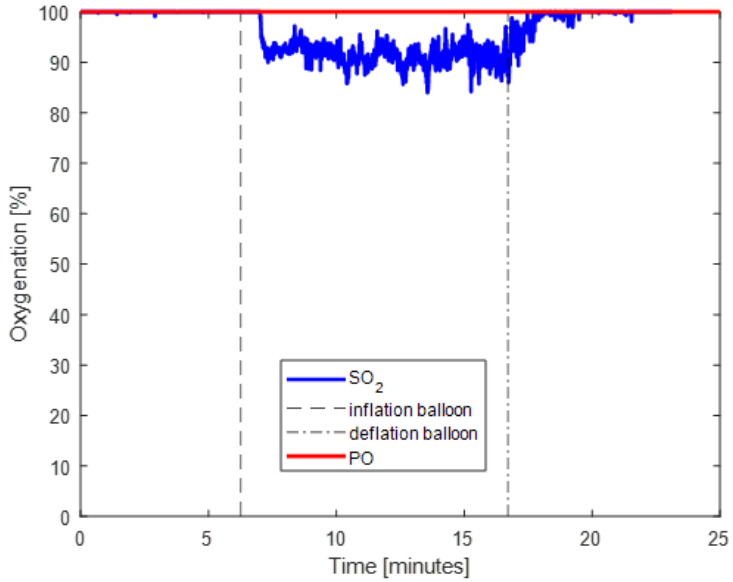

Figure 13. Blood oxygen saturation (%) in a right segmental artery was recorded before balloon inflation, during vessel occlusion, and after deflation.

DISCUSSION

The iBLOS wire is engineered for continuous, real-time monitoring of arterial blood oxygenation dynamics by detecting the spectral changes of oxy- and deoxy-hemoglobin. The system acquires oxygenation measurements multiple times per second. Our in vitro validation experiment confirmed excellent correlation between the iBLOS measurements and ABG measurements of oxygen saturation over a wide range of saturation levels. Delivered via an endovascular approach, the iBLOS wire permits real-time assessment of blood oxygen saturation within both patent and occluded vascular segments. In the porcine models, iBLOS blood oxygenation measurements obtained during unobstructed flow demonstrated a high degree of concordance with PO across a range of conditions, including normoxemia and severe hypoxemia induced by prolonged breath-holds. This concordance was surprising, since the accuracy of PO is known to decrease when arterial oxygen saturations drop to the range of 70-90% 9,10,11; an explanation for this finding is currently unclear. The iBLOS system and ABG measurements were less concordant than expected in conditions of severe hypoxemia during breath-hold. The main reason for the observed disparity is most likely due to technical difficulties encountered during blood collection for ABG measurements. Oxygen saturation levels changed quickly during the breath-hold and after ventilation was restored, which made it impossible to obtain a sample entirely from the vessel at a single, clearly defined timepoint for accurate analysis.

The technical limitations of the iSTAT ABG analyzer as detailed in the device specifications (decreased accuracy in hypoxemic states below 85% saturation4) may have also contributed to the difference. Because the PO and ABG measurements both provide systemic measurements of blood oxygenation and are less accurate during severe hypoxemia, it is difficult to fully validate the iBLOS system by confirming the accuracy of results in an in vivo environment.

For assessment of the iBLOS wire in the setting of vascular obstruction, we simulated mechanical recanalization using an embolectomy balloon catheter to achieve vessel occlusion and then advancing the iBLOS wire through the catheter and beyond the occlusion into the blood downstream. Under conditions of obstructed blood flow, the blood oxygenation values measured using the iBLOS system and PO exhibited significant discrepancies. This is attributable to the fact that only iBLOS technology assesses local variations in oxygenation distal to the obstruction, whereas PO provides measurements that exclusively reflect systemic blood oxygen saturation. The sudden occlusion of a blood vessel segment did not produce any detectable change in systemic oxygenation levels, underscoring the insensitivity of systemic oxygenation measurements for detecting localized ischemia during acute vascular events. In the context of obstructed blood flow, the principal advantage of the iBLOS modality was demonstrated by its unique capability to directly quantify local blood oxygenation distal to the site of vascular occlusion—an assessment unattainable via conventional ABG sampling or systemic pulse oximetry.

Both PO and the iBLOS system allow for continuous, real-time monitoring of blood oxygenation, in contrast to ABG, which necessitates intermittent blood sampling and incurs a temporal delay of approximately 4–6 minutes from collection to point-of-care analysis. A minor temporal shift was noted in the recorded response to hypoxemia between the iBLOS and PO measurements. The iBLOS wire records measurements two times per second whereas PO operates with an 8-second averaging window. Additionally, PO readings reflect averaged tissue values and might exhibit a slight delay compared to the local arterial oxygenation levels recorded by iBLOS, due to difference in blood flow and difference in distances to the heart.

The relative hypoxemia measured distal to vessel occlusion was more marked after SMA occlusion than after hepatic or renal artery occlusion. This suggests that collateral circulation in the anatomical territory of the SMA is insufficient to maintain adequate perfusion under acute ischemic conditions. Conversely, after the hepatic artery occlusion, subtle late-phase collateral

flow was noted. The small amount of collateral flow and the preserved portal venous flow likely contributed to the relatively preserved hepatic oxygenation despite complete interruption of arterial inflow. These results highlight the sensitivity of the iBLOS system in detecting regional changes in oxygenation and reveal the potential role of minor collateral pathways in sustaining tissue perfusion under ischemic conditions. After the segmental renal artery occlusion, oxygenation was again relatively maintained, although no collaterals were noted on angiography. However, in our clinical experience significant collateral flow tends to occur in renal segmental stenosis, and it is likely that there may have been early collateral recruitment not yet apparent on angiography.

We hypothesize that this novel technology could offer previously unattainable, clinically relevant insights into local oxygenation status distal to sites of vascular occlusion. Such advancements have the potential to deepen our understanding of ischemic core oxygenation dynamics in acute vascular events, including acute ischemic stroke, intracranial atherosclerotic disease, myocardial infarction, and acute limb ischemia.

The main limitation of the study was that both the ABG and PO methods are inaccurate at low saturation levels, which prevented effective benchmarking of the iBLOS technology across the full range of sub-physiological saturations.

CONCLUSION

Our study confirmed that intravascular blood oxygenation assessment with iBLOS technology is feasible in both unobstructed blood flow and vessel segments proximal and distal to vascular obstructions. iBLOS correlates well with standard systemic blood oxygenation measurement methods such as ABG analysis and pulse oximetry. The unique feature of the iBLOS sensing wire is its ability to measure blood oxygenation locally in real-time distal to a vascular occlusion where current methods such as ABG and PO cannot provide measurements. Given that iBLOS operates in real-time, thereby eliminating the need for extensive blood sampling and processing, and can detect local oxygenation drops, this technology has the potential to provide valuable insights into focal ischemic events. These findings pave the way for utilizing iBLOS in endovascular interventions aimed at recanalizing blood flow during acute vascular events.

Acknowledgments

We extend our sincere gratitude to the support staff at Cincinnati Children's Research Lab, whose contributions were invaluable to the execution of this study: Amanda Wallingford, Carolyne Doerning and the Veterinary team, Jaylynn Nash and the Imaging Business Research Team.

We also highly appreciate the support of Rinze van der Kluit and Ronald van Rijswijk (Philips, The Netherlands) and Mark Hehir, Charlotte Weir (Integer, Ireland) in the development of the sensing wire prototypes. We thank Willem Verkruijsse (Philips, The Netherlands) for valuable discussions on pulse oximetry results and Celine Cettour (Philips, The Netherlands) for support on the acquisition software.

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