Study sample, subject, and measurement exclusion.

112x80mm (600 x 600 DPI)
6. Online Supplement

(references are the same as the main article bibliography)

Study sample and exclusion

Figure S1: Study sample, subject, and measurement exclusion.

Hybrid DOS+DCS instrument and measurements

Details of the hybrid DOS+DCS instrument have been described elsewhere (30). Briefly, we utilized a commercial multi-wavelength FD-DOS device (Imagent, ISS Inc., Urbana, IL; 110 MHz; 690, 730, 790, and 830 nm at each of 4 spatial positions). We also used a custom-built DCS device containing 8 avalanche photodiode detectors (SPCM-AQ4C, Excelitas, Quebec) connected to a multiple-tau hardware correlator (Correlator.com, Bridgewater, NJ), and with two long-coherence length 785 nm laser sources (DL785-100-30, CrystaLaser, Reno, NV).

Baseline data consisted of modulated amplitude and phase of the diffuse photon density waves as a function of source-detector separation and wavelength; details on the algorithms used to extract tissue saturation ($StO_2$), hemoglobin content ($Hb_t$), and reduced scattering coefficient ($\mu'_{so}$) have been described previously (30).

On each patient monitoring day, optical baseline measurements were collected utilizing a custom-built flexible patient interface (‘probe’, ISS Inc.) with embedded fiber optics (16 400 µm 0.22 NA source fibers in groups of 4 at 1.5, 2, 2.5, and 3 cm from a 3mm 0.55 NA detector fiber) manually placed on the subject’s forehead (30). Due to necessary patient positioning for right
sided cannulation of the neck, it was frequently impractical to measure both sides of the head; data reported here were collected on the right side only. For each baseline period, tissue oxygen saturation \( (S\text{t}O_2) \), hemoglobin content \( (Hb) \), and reduced scattering coefficient \( (\mu'_{\text{so}}) \) were quantified (30).

After the baseline measurements, a lighter and more conformable hybrid DOS and DCS probe (Fiberoptic Instrument Sales Inc., Simi Valley, CA) was utilized for \( CA \) measurements. In this probe, a multimode fiber (100-\( \mu \)m core/0.22 NA) was used to illuminate the tissue. A fanout bundle of 3 to 8 single-mode fibers (780 HP/0.13NA) positioned 2.5 cm away from the source delivered diffusive light emerging from the tissue to a set of independent single-photon counting detectors. Normalized temporal intensity autocorrelation functions of the detected signals were computed from the photon arrival times (correlator integration time, \( \sim 2.5 \) s). The DCS blood flow index \( (\text{BFI}) \) was derived from the decay rate of the averaged autocorrelation function across the channels; a semi-infinite tissue model (22) was used for analysis. Continuous hemodynamic concentration/saturation measurements were conducted with a single source-detector separation (2.5cm, detector 600 \( \mu \)m 0.22 NA), precluding the multi-distance analysis utilized in the baseline measurements. The FD-DOS baseline measurements were utilized as inputs into the analysis of the continuous hemodynamic and DCS measurements. Temporal FD-DOS \( S\text{t}O_2 \) and \( Hb \) data were calculated using measurements of temporal changes from baseline in oxy- and deoxy-hemoglobin concentration obtained with a modified Beer-Lambert paradigm (40) that utilized semi-infinite tissue models and the measured baseline optical properties (31).

Temporal FD-DOS \( S\text{t}O_2 \) and \( Hb \) data were calculated using measurements of temporal changes from baseline (31) in oxy- and deoxy-hemoglobin concentration with a semi-infinite modified Beer-Lambert paradigm (40). FD-DOS temporal data was only available for 15 of 22 monitoring
sessions. The DOS measurement was particularly sensitive to signal-to-noise issues due to the relatively small source and detector fibers required for the lightweight, comfortable probe.

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