NeoDoppler monitoring of cerebral blood flow during general anesthesia in infants

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Background

- General anesthesia is associated with neurocognitive deficits in young infants undergoing non-cardiac surgery
- A potential cause underlying this association may be cerebral hypoperfusion related to systemic hypotension and impaired autoregulation

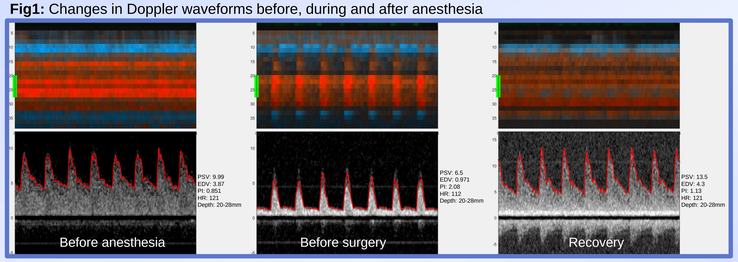
Objectives

- We aimed to study cerebral blood flow velocities (CBFV) continuously using a new ultrasound system, NeoDoppler[1], during general anesthesia in infants undergoing non-cardiac surgery
- Compare variations in CBFV to simultaneously measured near-infrared spectroscopy (NIRS), blood pressure (BP) and heart rate (HR)

Methods

- CBFV was monitored with NeoDoppler via the anterior fontanel during induction and maintenance of general anesthesia before start of surgery, and during recovery
- Simultaneous recordings of NIRS, BP and HR were obtained
- Fig 1 shows Doppler waveforms obtained from one patient

Fig1: Changes in Doppler waveforms before, during and after anesthesia



PSV=peak systolic velocity, EDV= end diastolic velocity, PI= pulsatility index, HR=heart rate

Results

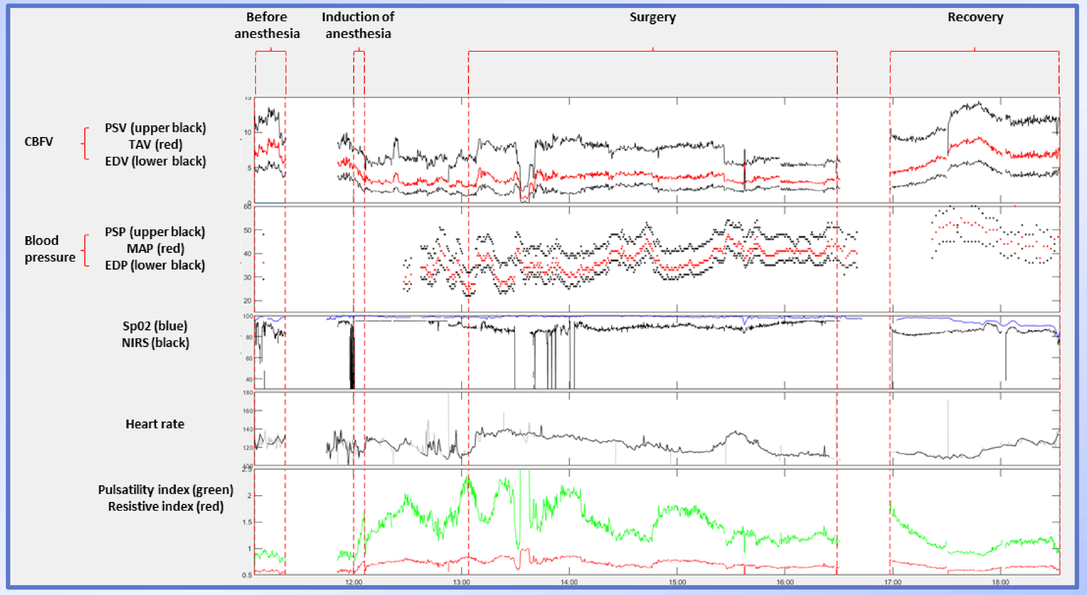


Fig2: Characteristic patterns of CBFV, NIRS, HR and PI before, during and after anesthesia in one infant with duodenal atresia, gestational age 37 weeks

- 18 infants (13 boys) with median postmenstrual age at surgery 37.6 weeks (range 31.7-60) were included
- The trend curves showed a decrease in CBFV during induction of anesthesia compared with baseline (Fig 2)
- Compared with baseline values, end diastolic velocities (EDV) decreased in all children, on average by 51% during anesthesia, while the reduction in mean and end diastolic blood pressure was about 20% (Table)
- EDV returned to baseline values during recovery (Fig1, Fig2 and Table)
- Pulsatility index increased in all, but one child compared to baseline values during anesthesia (Table)

Table: Changes in percent from baseline of mean CBFV (PSV, EDV, PI), NIRS and blood pressure before surgery (during anesthesia) and during recovery

		Baseline	Before surgery	Recovery
PSV	% of baseline (range)	100	87 (47-177)	109 (49-199)
EDV	% of baseline (range)	100	49 (15-95)	105 (49-207)
MAP	% of baseline (range)	100	79 (43-106)	103 (78-154)
EDP	% of baseline (range)	100	80 (35-146)	111 (82-164)
PI	% of baseline (range)	100	187 (100-254)	106 (48-152)
NIRS	% of baseline (range)	100	99 (73-110)	94 (62-119)

PSV=peak systolic velocity, EDV= end diastolic velocity, PI= pulsatility index, NIRS= near infrared spctroscopy, PSP=peak systolic blood pressure EDP=end diastolic blood pressure

Conclusions

Continuous monitoring of cerebral blood flow velocity during general anesthesia showed

- Significantly reduced EDV with a concomitant reduction in blood pressure and stable NIRS values

In infants with an open fontanel NeoDoppler may

- Provide a more comprehensive assessment of cerebral blood flow than current monitoring tools
- Optimize cerebral perfusion during anesthesia

References

1. Vik SD. et al. Pediatr Res. 2020; 87 (1): 95-103.

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