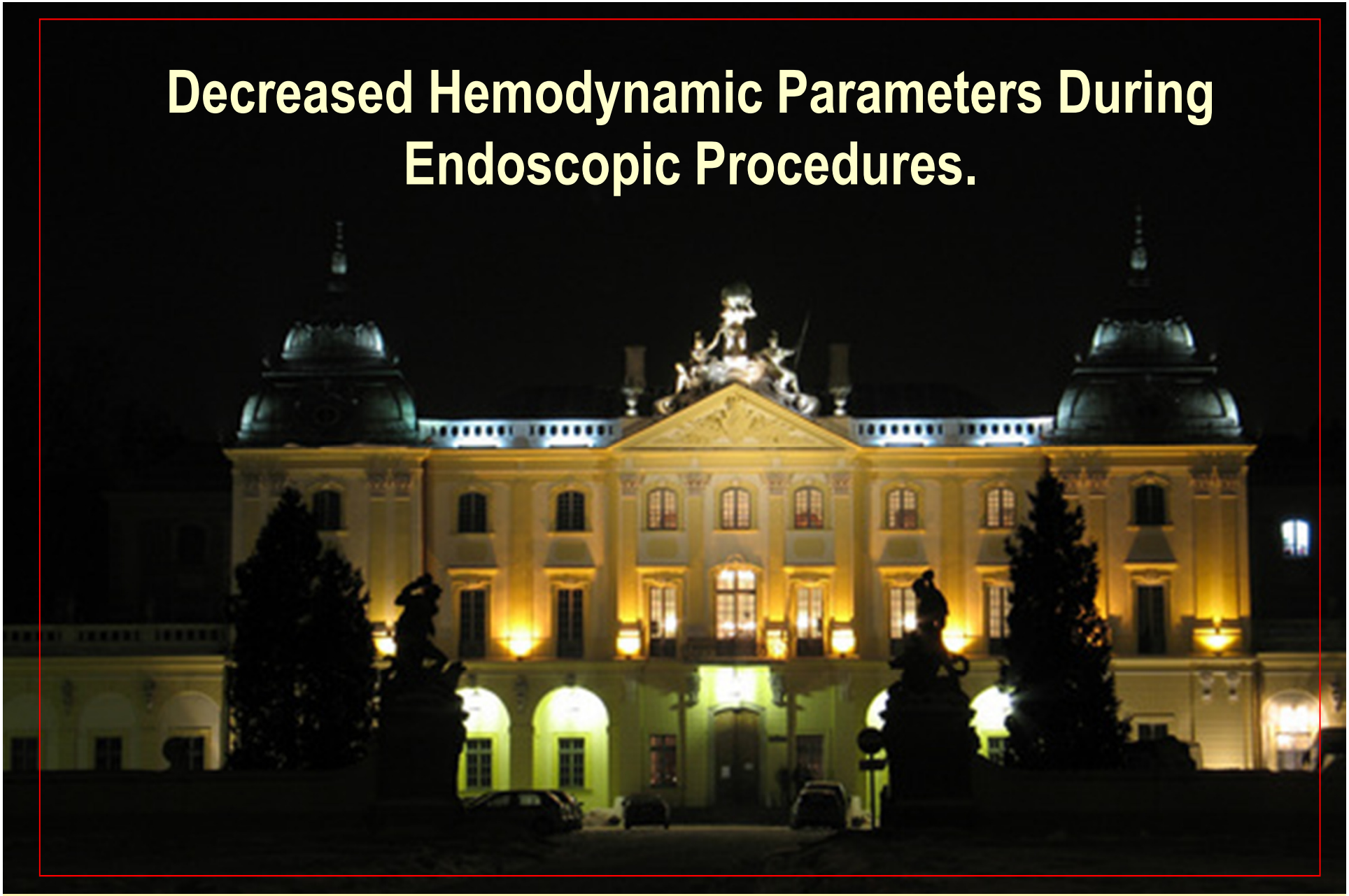
Decreased Hemodynamic Parameters During Endoscopic Procedures.



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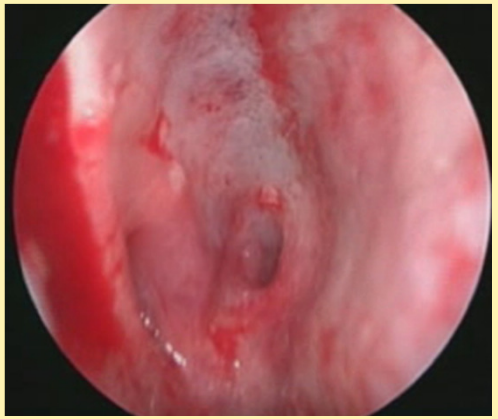
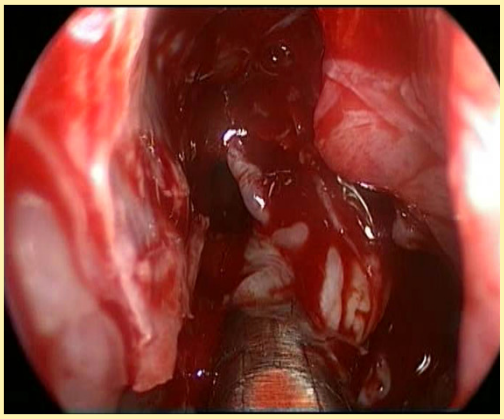
Negative impact of intraoperative bleeding on endoscopic treatment outcome

- Decreased precision –increased incidence of complication, residual disease
- Increased perioperative trauma, operative time,blood loss, hospital stay
- Increased costs of treatment

Factors contributing to intraoperative bleeding during endoscopic surgery

- Patient factors: obesity, smoking
- Density of nasal mucosal vasculature





Atrophic rhinitis Hypertrophic rhinitis

- Hemodynamic state of cardio-vascular system

Prevention of intraoperative bleeding

- Local anaesthesia
- Topical vasoconstrictors
- Reverse Trandenenburg position
- **Decrease of HR and BP**

may result in decreased cerebral perfusion and neurological complications

The study design

- During transnasal endoscopic operations the HR and BP was reduced to achieve bloodless surgical field (grade 0-2 in Fromme and Boezaart scale)

Grade I

Grade III

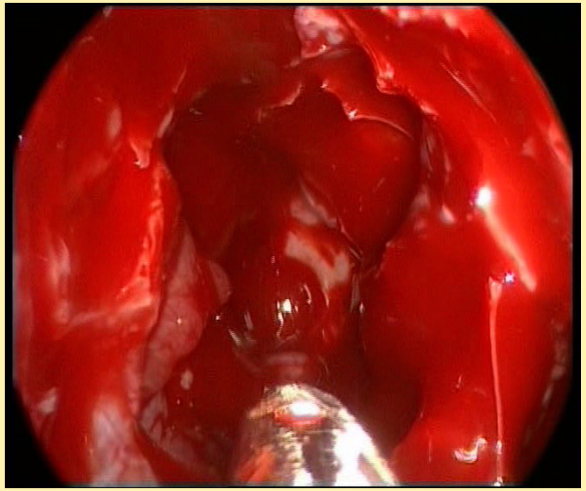
Grade V

The study design

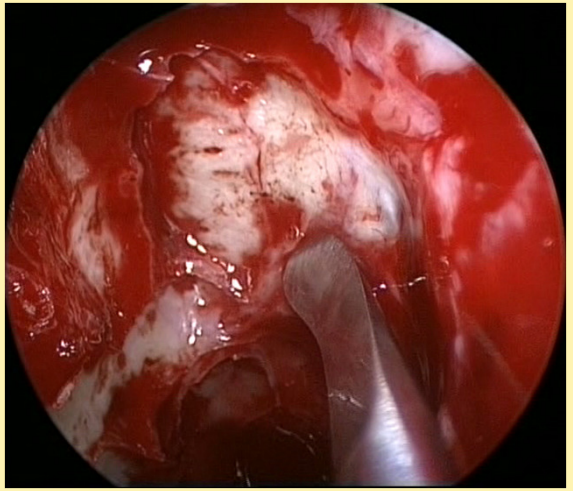
- When the bloodless surgical field was achieved due to reduced hemodynamic parameters (MAP 60-70, HR ca. 60) the blood flow in MCA was assessed with transcranial colour Doppler

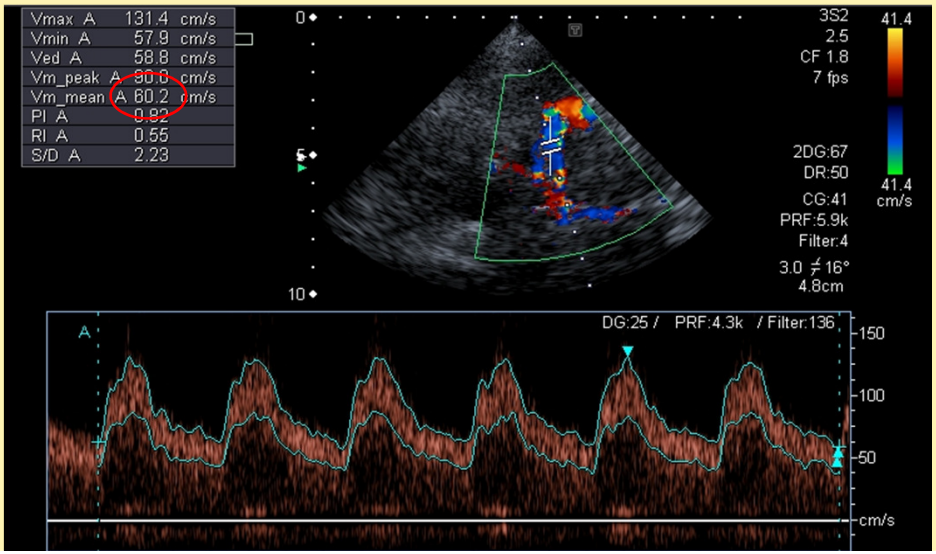
Results

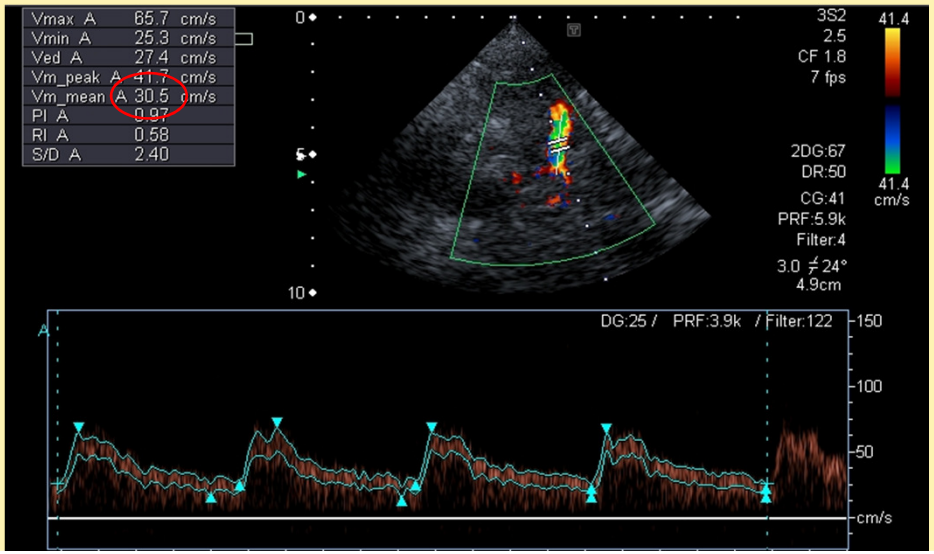
HR -78 bpm, MAP 80



HR - 62 bpm, MAP 65







Is it really save to reduce BP and HR to achieve bloodless surgical field during endoscopy?

CORRESPONDENCE: OUR EXPERIENCE

Is it safe to decrease hemodynamic parameters to achieve bloodless surgical field during transnasal endoscopic procedures? Our experience in fifteen patients

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Dear Editor,

During transnasal endoscopic operations, precision of surgical treatment is possible only if the intraoperative bleeding is reduced to a minimum. Poor visualisation contributes to elongation of the procedure and may lead to complications. Manoeuvres like putting the patient in the reverse Trandelenburg position and/or local application of vasoconstrictors prove insufficient for longer or more extensive procedures. In this situation, on surgeon's request, reduction in the patient's hemodynamic parameters is performed by anaesthesiologist.

Mean arterial blood pressure values between 50 and 150 mmHg are traditionally considered as corresponding to the physiological cerebral autoregulatory plateau. To support this notion, a classic study by Lassen can be quoted, who found only insignificant change in cerebral perfusion within this range of pressure in 376 human individuals using inert gas method.[1] What is more, even with further reduction in mean arterial pressure to values of 35–40 mmHg, still sufficient oxygen supply to the brain (as calculated from arteriovenous oxygen difference) can be maintained in normotensive persons, thanks to the mechanism of increased oxygen absorption from circulating blood.[2] Also several clinical series were reported in which heart rate was reduced to 60 bits/min in order to achieve bloodless operative field during endoscopic transnasal procedures. Such manoeuvre was proved to be safe because no patient developed any neurological deficit post-operatively.[3–5] From data like the cited above, one can conclude that reduction in mean arterial pressure in normotensive subjects to 60 mmHg and heart rate to 60 beats/min is generally safe. Nevertheless, with advances in anaesthetic methods, more and more elderly patients with different health problems are operated on endoscopically. Apparently, these patients are not likely to tolerate decreased hemodynamic parameters as well as young healthy persons do.

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The velocity of blood flow in the major cerebral arteries may be assessed with transcranial colour-coded Doppler sonography and has been proved to correlate with cerebral perfusion.[6,7] In this study, we aimed at assessing changes in blood flow parameters in the middle cerebral artery when bloodless surgical field was achieved by reduction in hemodynamic parameters during transnasal endoscopic procedures.

Material and methods

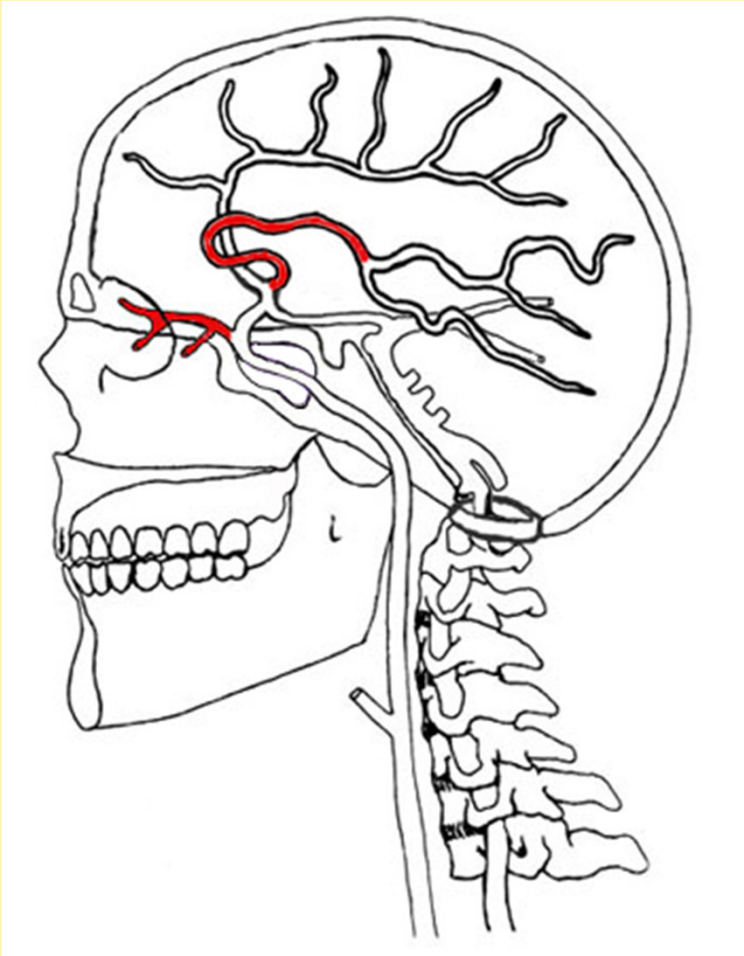
The study protocol was approved by the Institutional Bioethical Committee, and all participants have signed the informed consent. Fifteen patients (10 women and five men, age range 20–55 years) without the history of systemic diseases like hypertension, coronary heart disease, diabetes, respiratory disorders were qualified for the study and underwent endoscopic surgery for pathologies of paranasal sinuses and skull base.

General anaesthesia was performed according to standard protocol. Propofol at a dose of 2 mg/kg i.v. was used for induction followed by cisatracurium at the intubation dose of 0.1 mg/kg i.v. Sevoflurane at minimal alveolar concentration 0.8–1.5 and remifentanil in continuous infusion at a rate of 0.1–0.5 μg/kg/min were used for the maintenance of the anaesthesia.

Reduction in hemodynamic parameters was achieved by appropriate manipulation of anaesthetics doses. At the beginning, minimal alveolar concentration of sevoflurane was kept at the level of 0.8, and the infusion rate of remifentanil was gradually increased, not exceeding 0.5 μg/kg/min. Cardiodepressive properties of this agent caused conspicuous reduction in heart rate while mean arterial blood pressure was affected only slightly. When heart rate dropped close to the lower range of the physiological norm, that is, ca 60/min, further reduction in blood pressure (if necessary) was achieved by increase of minimal alveolar concentration of sevoflurane. Blood pressure and heart rate were reduced smoothly within 15–20 min to allow homoeostatic mechanisms (including cerebral autoregulation) to act.

- Bloodless surgical field denote also reduction of blood flow in the MCA
- Blood flow velocity may drop below normal reference range in some patients
- This drop may occur even though BP and HR are maintained in so called „save limits”

Is it really save to reduce BP and HR to achieve bloodless surgical field during endoscopy?



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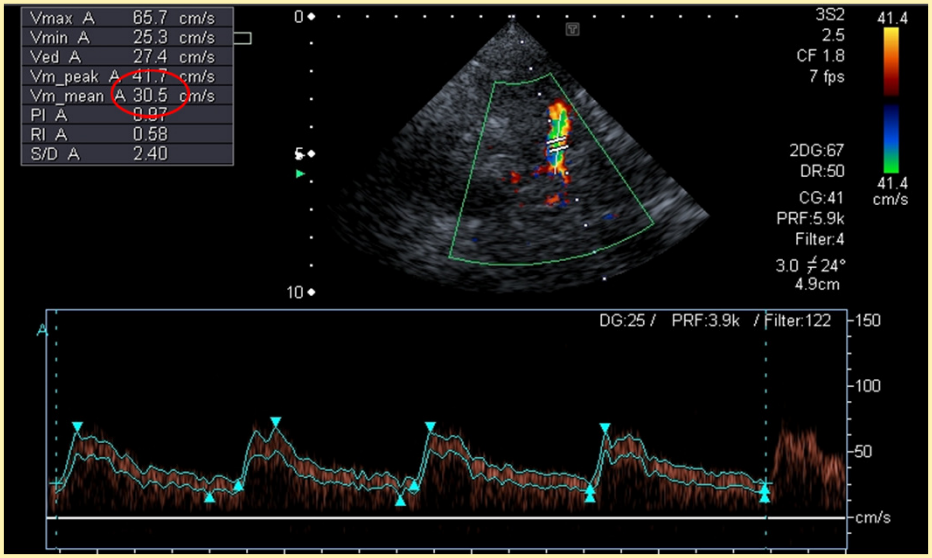

Lower limits of blood flow velocity
35 cm/s > 41 years old
41 cm/s < 40 years old

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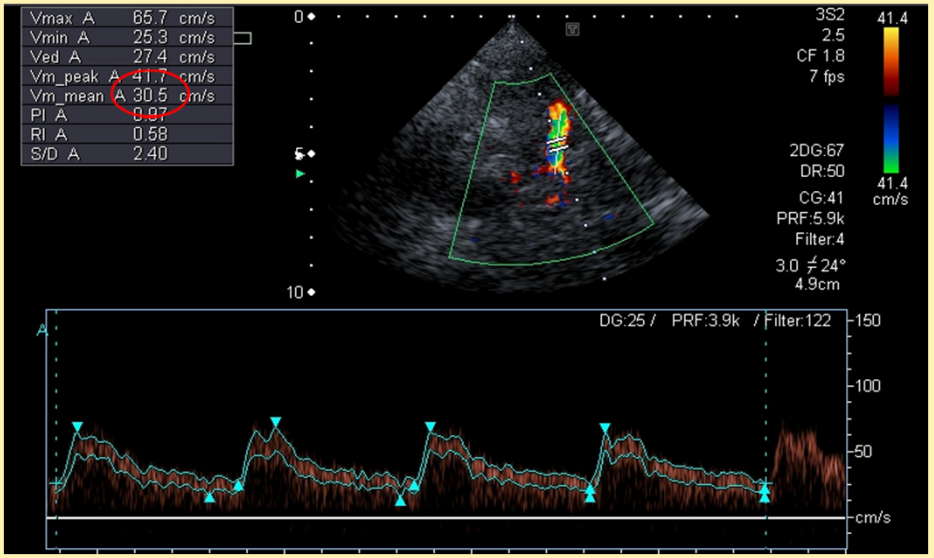


Mean arterial blood preasure above 60 mmHg
Heart rate above 60 bpm

- Bloodless surgical field denote also reduction of blood flow in the MCA
- Blood flow velocity may drop below normal reference range in some patients
- This drop may occur even though BP and HR are maintained in so called „save limits”

Results

V_m (cm/s)		Norm
Before anaesthesia	Decreased BP and HR	
70,6		20 – 40 years: 41-121 cm/s
75		
83,4		
55,83		
80		
60,3		
66,3		
85		
56,6		
79,67		41 – 60 years: 35-111 cm/s
44,5		
71,1		
110,7		
70,1		
77,5		

- Blood flow velocity in the middle cerebral artery (MCA) remained within the range of age-specific reference values in all patients before the induction of anesthesia

Results

V_m (cm/s)		Norm
Before anesthesia	Decreased BP and HR	
70,6	45,2	20 – 40 years: 41-121 cm/s
75	48,3	
83,4	44,9	
55,83	43,67	
80	50,3	
60,3	**30,7**	
66,3	43,1	
85	43,4	
56,6	48,5	
79,67	**32,8**	41 – 60 years: 35-111 cm/s
44,5	**20**	
71,1	**40,1**	
110,7	**25,7**	
70,1	52,7	
77,5	**28,6**	

- Satistically significant drop (reduction by 45%; $p<0.01$, Wilcoxon test) was detected when bloodless surgical field was achieved due to decreased hemodynamic parameters.

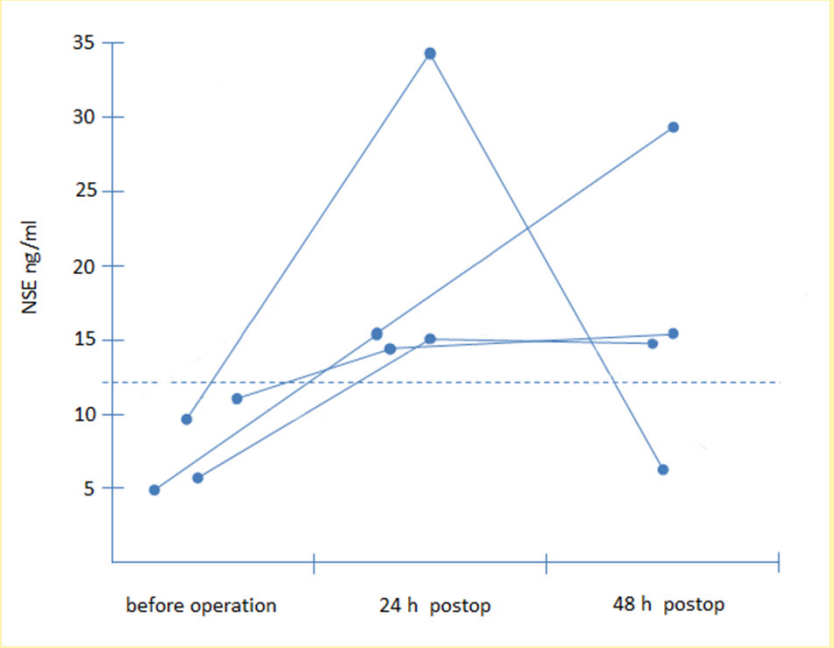
The mean blood flow velocity dropped below the normal reference values in 40% of patients – marked with gray colour

Results

V_m (cm/s)	
Before anesthesia	Decreased BP and HR
70,6	45,2
75	48,3
83,4	44,9
55,83	43,67
80	50,3
60,3	**30,7**
66,3	43,1
85	43,4
56,6	48,5
79,67	**32,8**
44,5	**20** ✦✦
71,1	**40,1** ✦✦
110,7	**25,7** ✦
70,1	52,7
77,5	**28,6** ✦✦

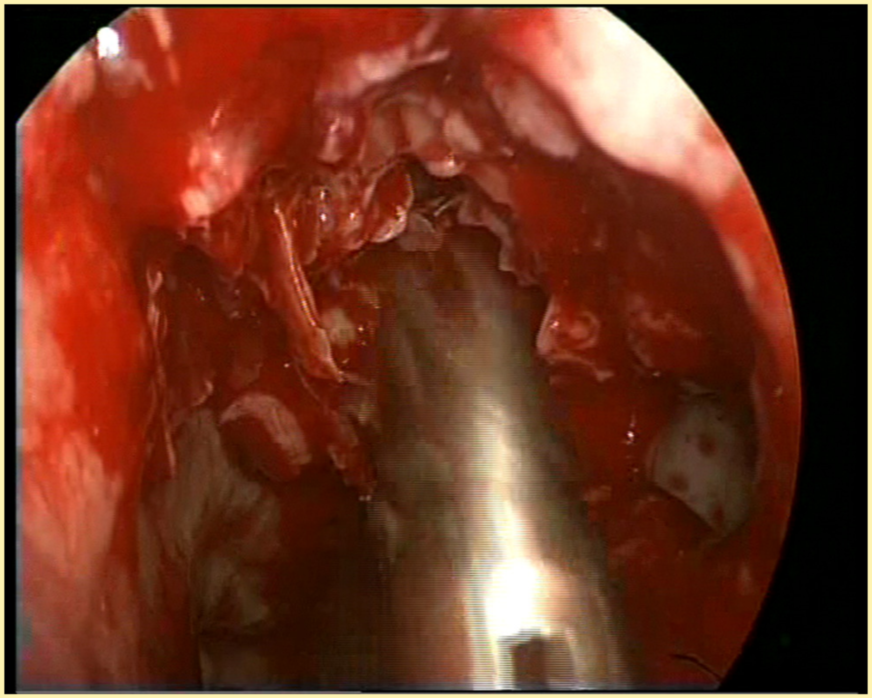
Neuron specific enolase (NSE)
assessed preoperatively, 24 and 48 h postop
upper limit of normal reference range 12 ng/ml

✦ increased 24 h postop
✦✦ increased 48 h postop



No neurological complications were detected

Conclusions



- **Reduction of hemodynamic parameters and decreased** bleeding in surgical field, MCA the drop of blood flow velocity in MCA values **which are well below the normal reference range** in healthy subjects.

- Further investigation concerning the safety of the method is warranted (other causes may exist, pathophysiology) in the rise of serum NSE concentration in operated patients.

Thank You for your attention