Xenon anesthesia in healthy volunteers increases norepinephrine plasma concentration despite of unchanged sympathetic neural outflow to muscle

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Modern volatile anesthetics inhibit sympathetic neural activity and decrease both cardiac output and systemic vascular resistance by direct and indirect mechanisms [1]. Particularly in patients with cardiovascular diseases, the resulting decreases in arterial blood pressure are unfavorable und reversed by intravenous administration of vasopressors. In contrast, xenon anesthesia combined with opioids does not alter cardiac output and systemic vascular resistance. Since the sympathetic nervous system contributes to short-term blood pressure stabilization at rest and during cardiovascular challenges we test the hypothesis that muscle sympathetic activity (MSA) and sympathetic baroreflex control are not altered during xenon mono-anesthesia in healthy volunteers.

Material and Methods: Following IRB approval this clinical phase I study was approved by German Authorities (EudraCT No 2009-012449-48) and registered at www.clinicaltrials.gov (NCT01043419). Muscle sympathetic activity (MSA, microneurography), norepinephrine plasma concentrations (HPLC), blood gas analyses, ventilation, heart rate (ecg), and radial arterial pressure were determined in 8 healthy volunteers in the awake state and during xenon anesthesia with spontaneous breathing. Moreover, sympathetic baroreflex gain was assessed during spontaneous blood pressure variations [2]. Anesthetic depth was monitoring by Narcotrend EEG index.

Statistics: means ± standard deviation, students t-test, $p<0.05$

Results: Xenon anesthesia (endtidal Xenon 63% ±6) decreased the EEG index from 98±1 to 46±10. Mean arterial pressure (93 mmHg ±4 to 107±6) significantly increased during xenon. While MSA (19.2 bursts min^{-1} ±10) and spontaneous sympathetic baroreflex gain (-3.7 bursts/100 heart beats mmHg ±1.5) were not altered, norepinephrine plasma concentration increased from 156 pg ml^{-1} ±55 to 292±106. Despite increased minute ventilation (6.9 l min^{-1} ±2.0 to 10.9±2.1) arterial pCO_2 and pH were not altered.

Conclusion: Despite unchanged MSA and sympathetic baroreflex gain norepinephrine plasma concentrations increased during xenon anesthesia. Since MSA correlates well with sympathetic outflow in many other organs and xenon shows NMDA-receptor inhibiting activity we speculate that norepinephrine plasma concentrations are increased due to impaired norepinephrine reuptake as demonstrated for the NMDA-receptor antagonist ketamine [3]. With respect to clinical anesthesia, increased norepinephrine plasma concentration during xenon makes administration of intravenous vasopressors redundant.

References:

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