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Neonates with elevated levels of aldosterone may be more vulnerable to long-term developmental effects of sevoflurane

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Growing numbers of neonates with pathophysiological conditions characterized by excessive levels of ALD (preterm birth, sepsis and many others) survive thanks to advances in modern medicine, including anesthesiology. However, the high incidence of long-term developmental complications in these patients is a rising concern. We sought whether subjects with pathophysiological conditions that are characterized by elevated levels of aldosterone have increased susceptibility to the side effects of neonatal anesthesia with sevoflurane.

Postnatal day 4-20 (P4-P20) rats were exposed to 6% and 2.1% sevoflurane for 3 min and 60-360 min, respectively. Exogenous aldosterone was administered to imitate pathophysiological conditions with elevated levels of aldosterone. Sevoflurane increased plasma levels of aldosterone, increased activation of caspase-3 and reduced the prepulse inhibition (PPI) of the acoustic startle response. Spironolactone, a mineralocorticoid receptor inhibitor, diminished activation of caspase-3 and improved PPI of startle, but did not depress seizure-like activity caused by sevoflurane. Exogenous aldosterone further increased sevoflurane-induced seizure-like activity, levels of activated caspase-3 and disruption of PPI of startle. The Na+-K+-2Cl- co-transporter inhibitor, bumetanide, diminished sevoflurane-induced activation of caspase-3 and improved PPI of startle, even though bumetanide further increased plasma levels of aldosterone and failed to depress seizure-like EEG patterns enhanced by exogenous aldosterone. Intracerebral administration of oxytocin and carbetocin alleviated the sevoflurane-caused side effects. These results suggest that adverse developmental effects of neonatal anesthesia with sevoflurane may involve both central and peripheral actions of the anesthetic. Subjects with elevated levels of aldosterone may be more vulnerable, while intracerebral oxytocin receptor agonists may be neuroprotective.

Biography

Anatoly Martynyuk is an Associate Professor at the University of Florida. He has received his Ph.D. and D.Sc. degrees from Bogomoletz Institute of Physiology, Kyiv, Ukraine, and Postdoctoral training from University of Glasgow, Dept of Medical Cardiology, United Kingdom.

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