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Tissue distribution and decay of Tempol after a single intravenous or intraperitoneal injection

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The study was focused on the tissue distribution and decay of a piperidine nitroxide, 4-hydroxy-2,2,6,6-tetramethylpiperidine-N-oxyl (Tempol) in the rat. The experiments were performed on 18 male, Wistar rats. The animals were sacrificed at a given time after the single dose (100 μmol/kg) intravenous or intraperitoneal injection of Tempol. Selected tissues and blood were collected, homogenized in phosphate buffer alone and in combination with benzene and assayed with the electron paramagnetic resonance spectroscopy (ESR) for Tempel. Tempol highly accumulated in plasma and red blood cells, wherein it persisted over 6 hours. Significant triplets of the ESR Tempol peaks were detected in lung, pancreas and heart. Lower, but significant intensity of the Tempol ESR signal was found in brain and soleus muscle, whereas only negligible and transient presence of Tempol was revealed in liver, kidney and testis. As shown by comparison of half-life and the time of 90% decay, the Tempol elimination rate was as follows: red blood cells ≤ plasma < lung < soleus muscle ≤ brain ≤ pancreas ≤ heart < liver < kidney < testis. Monoexponential rate of Tempol decay was observed in heart, soleus muscle and pancreas, whereas its elimination from plasma, red blood cells and lung obeyed the second-order kinetics. In pancreas and kidney Tempol was localized in aqueous compartment, but in lung, liver and testis it appeared predominantly in lipid environment. Prolonged persistence of Tempol in bloodstream and some tissues after a single intravenous or intraperitoneal administration confirms that Tempol not only can serve as a potential research tool for short lasting experiments but also can be of relevant potential in chronic protocols.