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## Effects of Intravenous $Mg^{2+}$ Infusion on Adrenal Sympathetic Ganglionic Transmission

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### Summary

**Background:** It has been suggested that  $Mg^{2+}$  suppress norepinephrine (NE) release from sympathetic nerve endings by inhibition of N-type  $Ca^{2+}$  channel current. We have reported that both N- and P/Q-type  $Ca^{2+}$  channels control acetylcholine (ACh) release on the pre-ganglionic splanchnic nerve endings while L-type  $Ca^{2+}$  channels do not.

**Purpose:**  $Mg^{2+}$  may inhibit ACh release from pre-ganglionic splanchnic nerve endings, leading to the suppression of catecholamine release from adrenal medulla. Then we examined the effects of  $Mg^{2+}$  on the adrenal ganglionic transmission.

**Methods:** We applied microdialysis technique to the left adrenal medulla of anesthetized rats and monitored ACh release from pre-ganglionic splanchnic nerves and NE and epinephrine (Epi) release from adrenal chromaffin cells. We investigated the effects of intravenous administration of  $MgSO_4$  on the release of ACh, NE, and Epi.

**Results:** Intravenous administration of  $MgSO_4$  (25  $\mu\text{mol/kg/min}$  for 30 min) increased plasma  $Mg^{2+}$  levels from  $0.92 \pm 0.04$  to  $2.47 \pm 0.07$  mM and suppressed the nerve stimulation (10 V, 4 Hz, 2 min)-induced release of NE by ~27% and Epi by ~16%, but did not change ACh release. Intravenous administration of  $MgSO_4$  (50  $\mu\text{mol/kg/min}$  for 30 min) increased plasma  $Mg^{2+}$  levels from  $0.86 \pm 0.03$  to  $3.84 \pm 0.22$  mM and suppressed the nerve stimulation-induced release of ACh by ~24%, NE by ~58%, and Epi by ~44%. Intravenous administration of  $MgSO_4$  (50  $\mu\text{mol/kg/min}$  for 30 min) also suppressed the exogenous ACh-induced release of NE by ~37% and Epi by ~23%.  $Na_2SO_4$  (50  $\mu\text{mol/kg/min}$  for 30 min) did not change the nerve stimulation-induced release of ACh, NE, Epi. Simultaneous administration of  $CaCl_2$  (50  $\mu\text{mol/kg/min}$  for 30 min) with  $MgSO_4$  (50  $\mu\text{mol/kg/min}$  for 30 min) reduced the suppression by  $MgSO_4$  of nerve stimulation-induced release of ACh, NE, and Epi.

**Conclusions:**  $Mg^{2+}$  acts on both pre- and post-ganglionic sites of adrenal sympathetic ganglion and inhibits catecholamine release from adrenal medulla, but post-ganglionic site is more sensitive to  $Mg^{2+}$  than pre-ganglionic site. Administration of  $Ca^{2+}$  reduces this inhibitory action of  $Mg^{2+}$ .