Brain death induced haemodynamic failure in the rat is solely due to autonomic denervation

Herijgers P, Mubagwa K, Dohmen P, Flameng W

Introduction
The marked haemodynamic collapse after brain death (BD) in the rat * makes this species a frequently used model to investigate the mechanisms underlying this phenomenon. Since we were unable to demonstrate intrinsic myocardial damage caused by BD in rats, we have tested the hypothesis that the BD-induced haemodynamic collapse is due to sympathetic failure.

Methods
We investigated whether high-dose sympathetic blockade is sufficient to mimic the collapse. Administration of phentolamine (Phe; 10 mg/kg IV, followed by 10 mg/kg/hr) or propranolol (Prop; 1 mg/kg IV, 0.5 mg/kg/hr) or a combination of both drugs was started either 15 min before or 30 min after BD, induced by sudden 300 µl inflation of an intracranial balloon in rats anaesthetized with urethane and chloralose (n = 6 in every series). Arterial blood pressure (ABP), left ventricular pressure (LVP) and ist derivative (dP/dt), cardiac output and heart rate (HR) were continuously measured. Central venous pressure was kept at 4 mm Hg. Factorial and repeated measurements ANOVA with LSD test for post-hoc testing was used to determine significant differences.

Results
While pretreatment with either Phe or Prop caused moderate changes of the haemodynamic function compared with those induced by BD, pretreatment with a combination of both drugs reduced ABP, systemic vascular resistance index (SVRI), LVP and dP/dt to levels seen in untreated rats after brain death. After the combined treatment, BD did not change the drug-induced haemodynamics situation. After BD, isolated (a- or b-) or combined adrenergic blockade had no influence on ABP, SVRI, LVP, and dP/dt. All described differences are significant (p<0.05).

Conclusion
The global haemodynamic picture after BD in the rat is one of profound sympathetic withdrawal.

* Reference