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Inhibition of cold induced damage of endothelial cells by catecholamines and related compounds

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Allocation of cadaveric donor organs became possible by successful preservation. Although hypothermic preservation is widely used for allografts from cadaveric donors, preservation time is associated with tissue injury and thus may have adverse effects on long-term transplantation outcome. Hence, hypothermic preservation and the tissue injury resulting from it may be inevitable. Tissue injury is supposed to be associated with delayed graft function and poor outcome of renal transplantation. We focused on cold-induced endothelial cells damage, attempting to explore protective effect exerted by catecholamines and the structurally related compounds.

Our data showed that cold storage could induce severe damages to HUVEC, which were manifested as DNA breaks and membrane damage, including that of lysosomal compartments and mitochondria. Free radicals, e.g. superoxide, may play an important role in mediating damage. The presence of extracellular calcium seems to be required. In addition, cold-induced cell injury was associated with proteolysis. There was no evidence that cold-induced cells damage was mediated via apoptosis, however proteolysis was likely to be involved. Catecholamines preconditioning of HUVEC could prevent against cold-induced damage, but the action of beta-adrenergic receptors was not involved herein. Protection was not specific for catecholamins, as a number of hemodynamic and non-hemodynamic compounds, displayed this feature. All these compounds had structural similarity in that they all contained a benze group.

In summary, this study provides evidence that cold storage induces membrane damage of endothelial cells. Preconditioning endothelial cells with catecholamines, or structurally related compounds, can prevent cold-induced damage. In view of the damage hypothesis our data may have clinical relevance since they suggest that donor conditioning may will be a promising approach to reduce preservation injury in allografts obtained from post-mortem donors, hence improving long-term transplantation outcome of these allografts