MYOCARDIAL HANDLING OF GLUCOSE DURING DIFFERENT RATES OF GLUCOSE INFUSION IN CONSCIOUS DOGS

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Intro slide

Factors which determine glucose uptake by the intact heart remain incompletely understood. As glucose is the only fuel which can provide energy anaerobically, it may be important during ischaemia. Vinyl catheters were implanted into the coronary sinus, femoral artery and femoral vein of healthy mongrel dogs. The first two catheters were utilised for simultaneous blood sampling and the third for infusions of glucose. Blood glucose concentration was determined by a glucose oxidase method. Myocardial extraction of glucose was calculated from the arterial-coronary sinus difference (CA-CS). A CA-CS for glucose of 100 µmol/l could be recognised with confidence at the 5% level.

Photos of op. proc + catheter

In eight studies, the arterial concentration of glucose was increased from 4482 ± 185 µmol/l to 6295 ± 556 µmol/l by an infusion of 420 µmol glucose/min. However, the CA-CS showed little change, being 93 ± 34 µmol/l before, and 148 ± 68 µmol/l during the infusion. The fractional extraction of glucose {(CA-CS/CA).100} was 2.2% and 2.1% respectively, a non-significant change. As a new higher steady state CA glucose had been reached during the infusion, it is unlikely that the infusion rate had exceeded first order kinetics or the capacity of the glucose removal system. It can be inferred that the glucose infusion rate exceeded the input of glucose from gluconeogenesis in the fasting state. At infusion rates of 5300 µmol/min, CA glucose regularly exceeded the renal threshold of 10000 µmol/l. At 10600 µmol glucose/min, CA glucose did not plateau, suggesting that first order kinetics (constant fractional pool removed/min) were clearly exceeded and zero order kinetics (constant amount removed/min) operative. The infusion rate which exceeded the glucose removal system and led to non-steady state arterial glucose concentrations was to some ~~extent~~ dependent on the time from surgery and, presumably, the presence of insulin antagonists.

There was no overall relationship between CA-CS glucose and CA glucose (r=0.09, n=24, p>0.05), a relationship which exists for other myocardial substrates. However, the glucose infusion rate was a significant determinant of CA-CS glucose (r=0.51, n=24, p<0.05). However it may not be a direct determinant as the amount infused will influence pancreatic insulin secretion and fatty acid mobilisation from adipose tissue, both of which have independent effects on myocardial glucose utilisation.

In order to work out the $k\left(=\frac{0.693}{T_{\frac{1}{2}}} \times 100\right)$ from infusion rate (at steady state), need conc^{n} + volume of distribution

Metabolic Clearance Rate = $\frac{\text{infusion (Total Tracer Rate)}}{\text{conc}^{n}}$ $\frac{\text{mol/min}}{\text{mol/l}}$ = M.C.R. (l/min)

% Clearance (F.T.R.) = $\frac{\text{M.C.R. (l/min)}}{\text{Volume of Distribution (l)}}$