

VIII. SUMMARY

Comparing examination of right and left ventricle isolated haemoperfused sheep hearts with Custodiol and BDM-containing cardioplegic solution

The aim of this project is the comparison of pressure generation in the right and left ventricle based on isolated cases of sheep's hearts hemoperfusion. The experiments were made in the scope of the MBF Project "Physiological hemoperfusion of isolated organs and the use for the replacement of animal experiments". The experiments were made with sheep hearts in the animal experiment department of the Charité. The animals all originated from one breed and were of comparable age and of same weight whereby a high degree of result reproducibility was achieved.

A system was implemented for the perfusion of the hearts which represents an extracorporeal circulation whereby the blood perfusion mixture was oxygenized and dialyzed and thermostated to constant temperature via heat circulation. The perfusion circulation was connected to dialysis circulation via a dialysis module.

50 % of the blood in the perfusion solutions consisted of autologous blood that had been taken from jugular vein of the animals before taking their hearts out. This share of blood guaranteed that the oxygen transport to the heart tissue was given - on the one hand for the colloidosmotic pressure and on the other hand by the haemoglobin contained.

The aim was to determine standard and reference values for pressure generation in both ventricles taking particular account of the values in the right ventricles. Hereby it was possible, with the help of the perfusion apparatus, to compare the performance of the sheep hearts after varying times of cardioplegia under isolated conditions.

Two partial experiments were carried out. In each part-experiment 15 sheep hearts were examined. In both parts of the experiment three hearts each were cardioplegia-treated and then connected to the perfusion apparatus characterised above. Both part-experiments were identical in overall procedure with the exception of the cardioplegia treatment solutions. In the first part, a self-produced modified cancer Henseleit solution with BDM additive was used, in the second part a ready-made Bretschneider's solution (Custodiol solution). As both the removal of the hearts and the cardioplegia treatment and also the following perfusion took place in the same building, a very good preservation of the heart was possible to enhance the comparability factor of the experiment.

Metabolic characteristics and organ characteristics such as heart frequency, organ resistance and coronary flow rate were used to characterise the stability of the system.

All the hearts underwent perfusion for a total period of one hour, whereby the first half of the experiment was to achieve a steady state after connecting the hearts. The measurements were made on the second half under unchanging conditions.

It was revealed that the hearts performed under pressure already after 15 to 20 minutes after being connected to a physiological frequency and also revealed a physiological organ flow and perfusion pressure with values of $60\text{-}120 \text{ ml}\cdot\text{min}^{-1}\cdot 100\text{g}^{-1} \text{ mmHg}$.

The established pressure values decreased in both ventricles in a different manner with both plegia solutions. the longer the cardioplegia time.

Thus the individual Custodiol values for the left ventricular end diastolic pressure was 74 % for 8 hours cardioplegia to 25 % for 36 hours compared to the initial values after one hour (100 %). In the case of left ventricular end diastolic pressure values for the BDM cardioplegia the corresponding figures were 64 % (8 hours) to 15% (36 hours).

The situation is vice-versa for the right ventricles, where, in comparison to the cardiopleged hearts with Custodiol in the BDM experiments, a lower percentage decrease of pressure differences resulted in comparison to the initial value.

Thus the values for 8 hours (right ventricular end diastolic pressure with BDM) at 55 % (right ventricular end diastolic pressure with Custodiol® at 29 %) and for 24 hours at 43 % and 25 %. After 24 hours of cardioplegia they reveal approximately the same value at 30 % and 31 % respectively. 36-hour values for the right ventricle could not be determined.

The experiment model described is therefore suitable for experiments on the isolated hemoperfusion of sheep hearts and can be utilised for further issues.