

1. Summary

Analysis of isolated normothermic and hemoperfused pig kidneys with and without substitution of albumin

Twenty one kidneys in three groups underwent an isolated normothermic hemoperfusion. The kidneys were taken from anaesthetised “german landrace” pigs with an average weight of 41 ± 7 kg. For cold conservation the “von Baeyer II” – solution was used and kidneys were conserved in a 4°C refrigerator for 117 ± 22 minutes. Thereafter, the kidneys were perfused with autologous blood at normotherm temperature (38°C) at least for 180 minutes.

One group (*group 1*) was perfused without albumin substitution. In *group 2*, 6 g albumin/l blood was administered and 20 g albumin/l blood was substituted in *group 3*.

In order to evaluate the kidney functions arterial and venous blood samples, dialyse-solution and urine samples were drawn and examined every 20 – 30 minutes.

The perfusion was accomplished particularly with regard to arterial pressure. A mean arterial pressure between 80 and 100 mm Hg was applied in order to avoid lesions in the organ caused by exalting pressure. Verapamil (a calcium channel blocker) was added once with the start of perfusion. Therefore it was possible to maintain a rate of more than 200 ml/min*100 g NG after 40 minutes of perfusion.

In *group 1*, the basal oxygen consumption amounted 90 $\mu\text{mol}/\text{min} \cdot 100\text{g NG}$, 70 in *group 2* and 100 $\mu\text{mol}/\text{min} \cdot 100\text{g NG}$ in *group 3*. Several kidneys in each group achieved even values exceeding 200 $\mu\text{mol}/\text{min} \cdot 100\text{g NG}$. This revealed a good organ vitality, particularly for the isolated perfused kidneys.

The expected protective effect of 20 g albumin/l blood for blood cells and therefore also for filtration in the hemofilter were confirmed in this model. In *group 3*, erythrocyte-levels (basal value: 6.1; after 180 min: 5.4 erythrocytes* $10^{12}/\text{l}$), concentration of hemoglobin (basal value: 5.9; after 180 min: 5.3 mmol/l) and the hematocrit (basal value: 30 %; after 180 min: 28 %) were constant.

The same parameters were clearly diminished in both other groups.

The erythrocyte-level in *group 1* declined from a basal value of 5.8 to 4.2 erythrocytes* $10^{12}/\text{l}$ after 180 minutes. The hemoglobin also declined from 5.9 to 4.5 mmol/l and the hematocrit declined from 29.5 % to 24 %. In *group 2* the values for erythrocytes were reduced from a basal value of 6.3 to 4.4 erythrocytes* $10^{12}/\text{l}$ after 180 minutes, the hemoglobin from 6.8 to 5.3 mmol/l and the hematocrit from 35 % to 24 %, respectively.

Summary

As expected, the colloid osmotic pressure (COP) declined in each group. In *group 3*, it was significantly higher at any time after albumin substitution (21 mm Hg after 60 min and 17.7 mm Hg after 180 min) compared to *group 1* (basal value: 13.9 mm Hg and after 180 min: 6.6 mm Hg).

With regard to the fractional sodium reabsorption, the use of albumin in *group 3* made the highest values possible (continuously between 90 and 93 %). The other groups achieved values between 77 and 81 (*group 1*) and 49 and 84 and (*group 2*), respectively. In the creatinin-clearance, similarities between *group 1* and *group 3* up to the last sample drawing were detected (start of perfusion: 28 and 29 ml/min*100 g NG, after 180 min: 17 and 22 ml/min*100 g NG). In *group 2*, the creatinin-clearance ranged between 14 and 17 ml/min*100 g NG.

The addition of 6 g albumin/l blood bears advantages for an isolated organ perfusion, as it helps to maintain the colloid osmotic pressure constantly. Though there was no beneficial effect with regard to the development of edema in *group 2*. We cannot exclude that cell debris, caused by a distinct hemolysis in this group, may have affected the kidneys.

The benefit of albumin in *group 3* (20 g/l), concerning the protective effect for blood cells, did not appear in *group 2* with 6 g albumin/l.

We proved that the fractional sodium reabsorption is best in *group 3* with 20 g albumin/l. The expected protective effect on erythrocytes was confirmed with 20 g albumin/l, but not with 6 g albumin/l. In some circumstances, a substitution of albumin could have a beneficial effect.