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Development of a Model for Simultaneous Normothermic Perfusion in Porcine Kidney Grafts

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Background and Aims: In recent years, DCD or ECD deceased donors have been increasingly used in kidney transplantation as a partial response to the deceased donor shortage, leading to a suboptimal quality of kidney grafts. There is a need for developing better kidney graft preservation methods, such as hypo- or normo- thermic machine perfusion. Machine perfusion might provide the unique opportunity to directly treat the perfused kidney grafts to improve their quality and to decrease ischemia/reperfusion injury during transplantation. Our aim was to develop a pig model of simultaneous normothermic perfusion of both kidneys procured from the same donor and to compare the assessment of renal function through the injection of creatinine and iohexol.

Method: Under general anaesthesia, the donor pigs (n=5) were euthanized by exsanguination and the blood was recovered using a cell-saving system. Both kidneys (n=10) were submitted to 30 min of warm and a 2-hour cold ischemia period, before being perfused for 6 hrs at 37°C. Kidney perfusion started and run in parallel using 2 independents, modified extracorporeal machines. Urine production, arterial blood gas exchange, and perfusion parameters (flow, pressure, resistance) were monitored and compared. Creatinine and iohexol were added to the perfusate of both machines to assess renal function.

Results: A parallel evolution of blood parameters in both perfusions was observed. By maintaining a constant perfusion pressure of 70 mmHg, flow rates increased to 100 mL/min. Despite variations in urinary excretion, creatinine and iohexol clearances remained comparable, demonstrating a parallel kidney function.

Conclusion: In conclusion, we established a model of parallel and simultaneous normothermic perfusion of pig kidneys, and for the first time, we demonstrated the utility of iohexol measurements for improved functional assessment in an isolated perfusion model. After randomization of the grafts, this model will be used for testing innovative therapies as MSC during perfusion, both in swine kidneys and human discarded grafts, using the contralateral kidney as a paired control.

Figure:

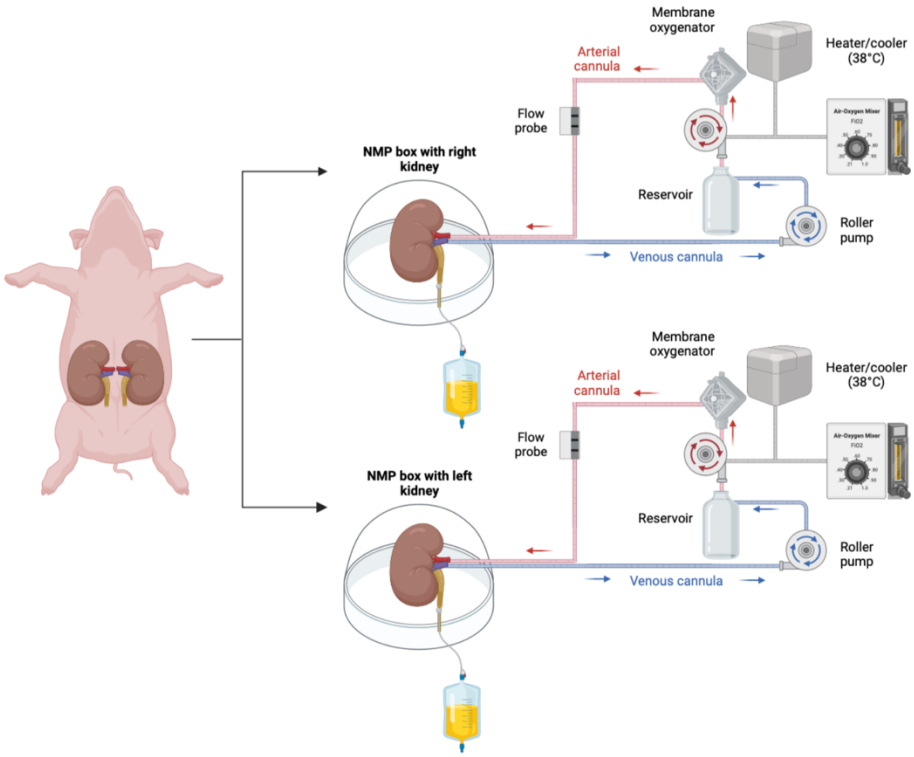

Figure 1: Scientific illustration depicting the extracorporeal circuit used to simultaneously perfuse two porcine kidneys.