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Successful application of allo-hemodialysis in a porcine model of embolization-induced acute kidney injury

Xin Wang1, Pinakin Soni2, Amrish Patel1, Dejan Nikolic2, Alexander Heide3, Jiaming Dong4, Vaibhav Maheshwari1, Nadja Grobe3, Shivanand Nayak2,5 and Peter Kotanko1,6

1Renal Research Institute, New York, United States of America
2Vivo Bio Tech Ltd, Siddipet District, Telangana, India
3Fresenius Medical Care AG, Bad Homburg, Germany
4Fresenius Medical Care R&D (Shanghai) Co., Ltd., Shanghai, P.R. China
5Virinchi Hospital, Hyderabad, Telangana, India
6Icahn School of Medicine at Mount Sinai, New York, United States of America

Background and Aims: Annually, millions of kidney patients, primarily in low- and low-middle income nations, die prematurely due to the lack of affordable kidney replacement therapy. We propose a novel, low-cost alternative dialysis modality called allo-hemodialysis (alloHD), where blood of a patient with kidney failure flows counter-current to the blood of a healthy subject (“buddy”) through the dialyzer [1]. Uremic solutes and excess fluid are then excreted by the buddy’s healthy kidneys. We have already demonstrated the technical feasibility of alloHD in pigs with acute kidney injury (AKI) induced by renal artery ligation [2]. In this study, we explored alloHD in a less invasive porcine model of AKI induced by renal artery embolization.

Method: The protocol was approved by the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), New Delhi, India. We studied two female Yorkshire pigs (weight 80-90 kg) with central venous catheter as vascular access. AKI was induced by embolization of both kidneys by transcatheter deployment of Contour™ Poly Vinyl Alcohol particles (Boston Scientific, Marlborough, MA, USA). The AKI pig and the buddy pig were connected to the dialysate and blood compartments, respectively, of a Nipro Cellentia 17H dialyzer. The AKI pig was then dialyzed for 4 hours against the healthy buddy pig. During alloHD, both pigs were anticoagulated with heparin (5,000 IU/h) and the buddy pig was sedated with 1-2% isoflurane gas. Blood samples were collected before, during, and after alloHD for measurements of blood urea nitrogen (BUN) and creatinine.

Results: We performed nine alternate day alloHD sessions with the same pair of pigs. During alloHD, BUN and Creatinine levels declined in the AKI pig (Fig. 1) and increased—as expected—transiently above baseline in the buddy pig and then trended towards baseline post-dialysis (Fig. 1). We found no indication of hemolysis or coagulation of the extracorporeal circuit in any of the nine alloHD sessions. The animals were sacrificed after the 9th session.

Conclusion: We demonstrated the feasibility of alloHD in a porcine embolization AKI model. This study corroborates and complements our previous experience with alloHD in a porcine model of AKI induced by renal artery ligation. Given these promising results, we are investigating the potential for advancing to a clinical trial.
Figure 1. Dynamics of plasma creatinine (panel A) and BUN (panel B) levels in the buddy (blue) and the AKI pig (red). Colored dot lines represent individual sessions, and colored solid lines depict the averages of the nine sessions. The dotted and solid vertical lines indicate the start and end of the alloHD session, respectively.

REFERENCES
