Magnetic Nanoparticles and AC Biosusceptometry system to study injured kidney perfusion and biodistribution in rats - preliminary results

André Gonçalves Próspero, Milena Foltran de Miranda, Guilherme Augusto Soares, Caio César Quini, Juliana Fernandes de Matos, Patrícia Fidelis de Oliveira

UNESP - Botucatu - SP - Brasil

Andris Figueirão Bakuzis, Nicholas Zufelato

UFG - Goiânia - GO - Brasil

Oswaldo Baffa Filho

USP - Ribeirão Preto - SP - Brasil

José Ricardo de Arruda Miranda

UNESP - Botucatu - SP - Brasil

Chronic Kidney Diseases (CKD) are a worldwide problem. The USA government estimates 11% of CKD incidence, increasing to 47% in people older than 70 years. In 2008, the Brazilian government stated that 200 in every one million people needed dialysis (1). Mostly, premature diagnostics and treatment for renal function are neglected, since current diagnosis tools present high costs, complexity and limited availability of necessary instrumentations (2). Most common protocols for such procedures involve Magnetic Resonance Imaging (MRI) and scintigraphy, which brings some disadvantages to their use. The scintigraphy uses ionizing radiation, which leads to dose incidence in the patient. For renal function evaluation protocols, the MRI needs to be associated with Gadolinium based contrasts, which are known for their nephrotoxicity (3) and may lead to worsening of the patient’s condition. In order to contribute to solve these problems, we have applied the Magnetic Nanoparticles (MNPs), as a tracer, and AC Biosusceptometry (ACB) system, as a detector, to study kidney injury in animal models, induced by a doxorubicin injection (well established method to induce CKD in rodents). We have showed in previous studies that the ACB system is able to detect MNPs in the kidney of rats in vivo and in real-time. The data collected here showed a different signal profile between the healthy and injured groups, where the signal intensity showed a higher kidney retention of MNPs in the injured animals, probably due to the macrophages infiltration in the injured kidney. Additionally, the system was able to quantify, post-morten, the biodistribution of MNPs in organs of interest (kidney, bladder, spleen, liver, lungs, heart and blood). The biodistribution data agrees with the in vivo data, showing higher MNPs accumulation in the injured kidneys. Our data also showed lower MNPs levels in the bladders from the injured animals, which can be related to the retention in the kidneys. In summary, we have successfully applied a new technique associated to MNPs to detect differences in the kidney perfusion in CKD induced animals. The system showed good and promising results that can be helpful to further understand the CKD stages and its evolution.