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Three-dimensional visualization of renal resident mononuclear cells with clearing in murine model of acute kidney injury

Ju-Young Moon[1], Dong-Jin Kim[1], Su-Woong Jeong[1], Yang-Gyun Kim[1], Sang-Ho Lee[1], Seung-Hae Kim[2]
[1]Department of Internal Medicine, Kyung Hee University Hospital at Gangdong, Korea, Republic of
[2]Department of Imaging technology, Korean Basic Science Institute, Korea, Republic of

Objectives: Traditional histologic methods are limited in their ability to detect pathologic changes in acute kidney injury. Recently, a multiphoton microscopy (MPM) with optical sectioning is an emerging method that provides three-dimensional visualization in detail. However, few studies applied this new technique to a murine model of acute kidney injury.

Methods: To induce acute kidney injury, CD11c-yellow fluorescent protein (YFP) mice received lipopolysaccharide (5μg/g) intraperitoneally, whereas a control group of CD11c-YFP mice did an equal volume of 0.9% saline. By applying the clearing with CLARITY, we compared CD11c-YFP cells within one millimeter-thick renal sections, which reflect resident renal mononuclear cells, between the murine model of acute kidney injury and controls.

Results: Mice that LPS was administered showed higher levels of serum blood urea nitrogen and creatinine than the control group (0.1 vs 0.6 mg/dL; $p < 0.05$). The main distribution of CD11c-YFP cells was located in the cortex and especially the tubulointerstitial area. The imaging of MPM demonstrated that number CD11c-YFP cells were significantly more densely interspersed within millimeter-thick tissue of acute kidney injury model compared with that of control (302 ± 16 *vs* 390 ± 21 cells; $p < 0.05$). Furthermore, it revealed that volume of CD11c-YFP cells more than 200 μm^3 were more frequently observed in mice with acute kidney injury than the control group (381 ± 50 vs 421 ± 100; $p < 0.05$).

Conclusions: MPM combined with optical clearing clearly provides the spatial distribution of target cells and its accurate counting within millimeter-thick tissue of murine model of acute kidney injury.