PET TRACER TO DIAGNOSE KIDNEY DISEASE

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Technology Description

Researchers at Washington University in St. Louis have developed a PET tracer that may be used to quantify kidney nephron endowment and diagnose kidney disease. Nephrons are the functional units of the kidney responsible for filtering the blood to remove waste. They are formed before birth and the number of nephrons can vary widely between individuals. Nephron number decreases with age and loss of nephrons is associated with development of kidney disease. Current techniques to monitor nephron number are inaccurate or destructive. Thus, new methods to assess nephron number are needed. To help meet this need the inventors have developed RadioCF- a targeted, natural, nanoparticle contrast agent detectable by PET. RadioCF is cationized ferritin with an iron core and labeled with CU-64. It binds transiently to the glomerular basement membrane of the kidney. Further, to maximize biocompatibility the inventors have developed a human recombinant form of cationic ferritin (HrCF) that may be used to generate RadioCF (WUSTL T-019017). RadioCF may be used to estimate nephron number and may serve as an early diagnostic for kidney disease. This technology provides a tool for non-invasive quantification of nephrons in living patients using PET.

Stage of Research

Proof-of-concept studies have been conducted in mice and show great promise.

Publications

- Charlton JR, Baldelomar EJ, Hyatt DM, Bennett KM. Nephron number and its determinants: a 2020 update. Pediatr Nephrol. 2020 Apr 29. doi: 10.1007/s00467-020-04534-2. Online ahead of print.
- Bennett KM, Baldelomar EJ, Morozov D, Chevalier R, Charlton JR. New imaging tools to measure nephron number in vivo: Opportunities for developmental nephrology. (Invited Review). J Dev Orig Health Dis. 2020 Jan 27:1-5. doi: 10.1017/S204017442000001X. Online ahead of print.

Applications

- PET tracer to diagnose and monitor kidney disease by assessing nephron endowment in:
    - Patients at risk for kidney disease
    - Transplant recipients

Key Advantages

- Targeted, natural, nanoparticle contrast agent
    - Enables non-invasive determination of nephron endowment

  - Readily functionalized
  - Modifiable core
  - Potential to replace traditional biopsy
  - Potential to allow earlier diagnosis of kidney disease
  - Can be detected in micro-doses to reduce the potential for toxicity
- Formulation and synthesis allows for rapid radiolabeling to prevent radioactive decay before PET imaging
- HrCF:
  - First human-based, targeted, nanoparticle contrast agent for quantitative renal imaging
  - Improves biocompatibility
  - Allows for more regulated loading of iron
- Can be used as a combined PET-MRI agent
- May be rapidly translated to clinical use
- Can be used with existing PET machines

Patents

- Patent application has been filed.

Related Web Links

- Dr. Kevin Bennett profile