Electronic Supplementary Information

Three-dimensional Angiography Fused with CT/MRI for Multimodal Imaging of Nanoparticles Based on $Ba_4Yb_3F_{17}$: Lu^{3+}, Gd^{3+}

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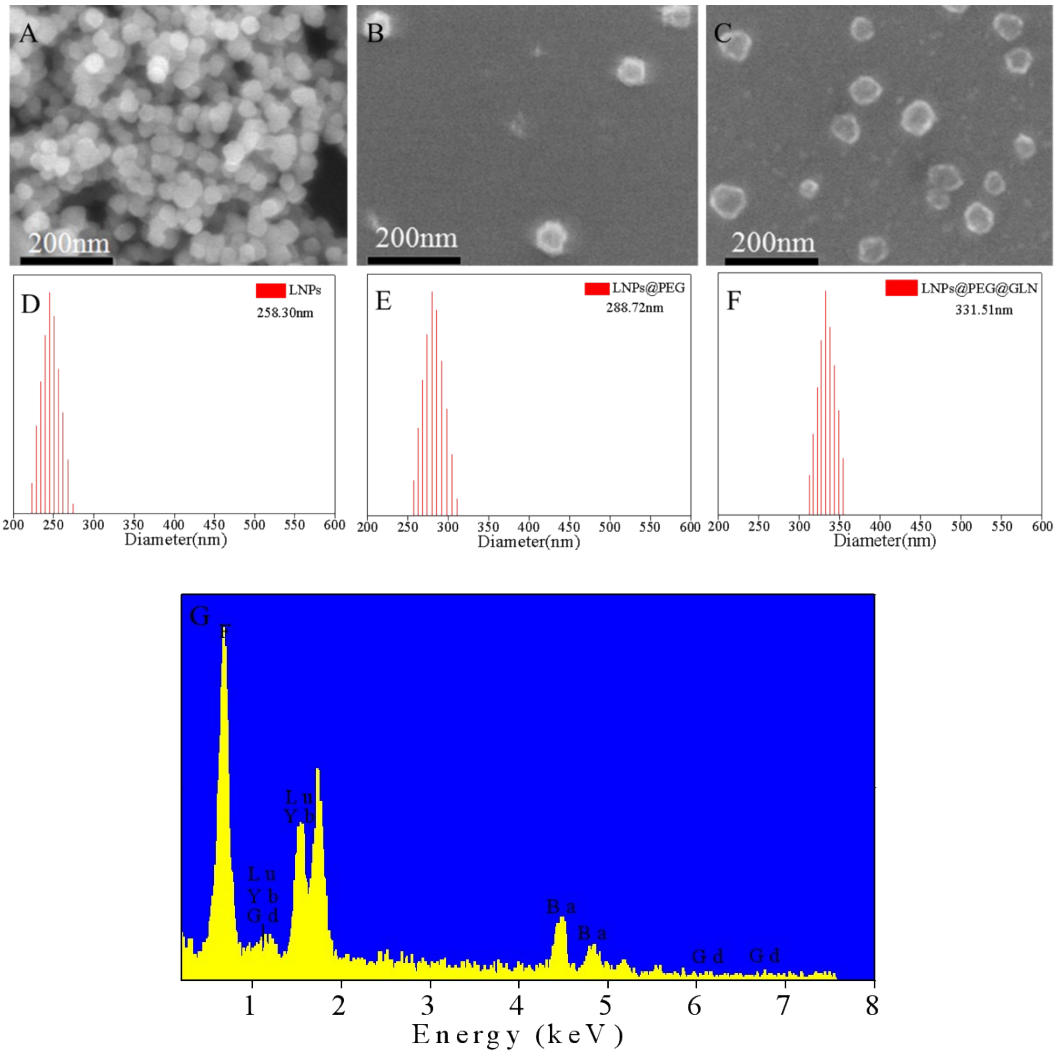

Figure S1. SEM and DLS images of multi-functional contrast agents. SEM images of (A) LNPs (B) LNPs@PEG (C) LNPs@PEG@GLN, DLS images of (D)-(F) hydration particle size

distribution of contrast agents LNPs, LNPs@PEG and LNPs@PEG@GLN, respectively. (G) EDS image of LNPs. Diaplaying the composition of nanoparticles.

Table S1. Concentration-dependent CT value *in vitro*

Concentration	0mg/ml	1.2mg/ml	2.5mg/ml	5.3mg/ml	7.9mg/ml
LNPs@PEG@GLN	161.1	210.6	258.7	324.5	426.3
Ioversol	168.3	201.5	250.1	305.3	375.5

Table S2. MRI T_1-weighted value *in vitro*

Gd^{3+} Concentration（μM）	0	0.0113	0.0226	0.0294	0.0362
LNPs@PEG@GLN（$1/T_1$）	0.000339	0.000617	0.000951	0.001062	0.001255

Table S3. MRI T_2-weighted value *in vitro*

Concentration（μM）	0	0.071	0.141	0.184	0.226
LNPs@PEG@GLN（$1/T_2$）	0.00142	0.08104	0.14492	0.17857	0.20408

Table S4. Fluorescence uptake value *in vitro*

Concentration（mg/ml）	0.5	1	3	6	9

LNPs@PEG@GLN	**0.98**	**2.03**	**2.50**	**3.48**	**9.36**

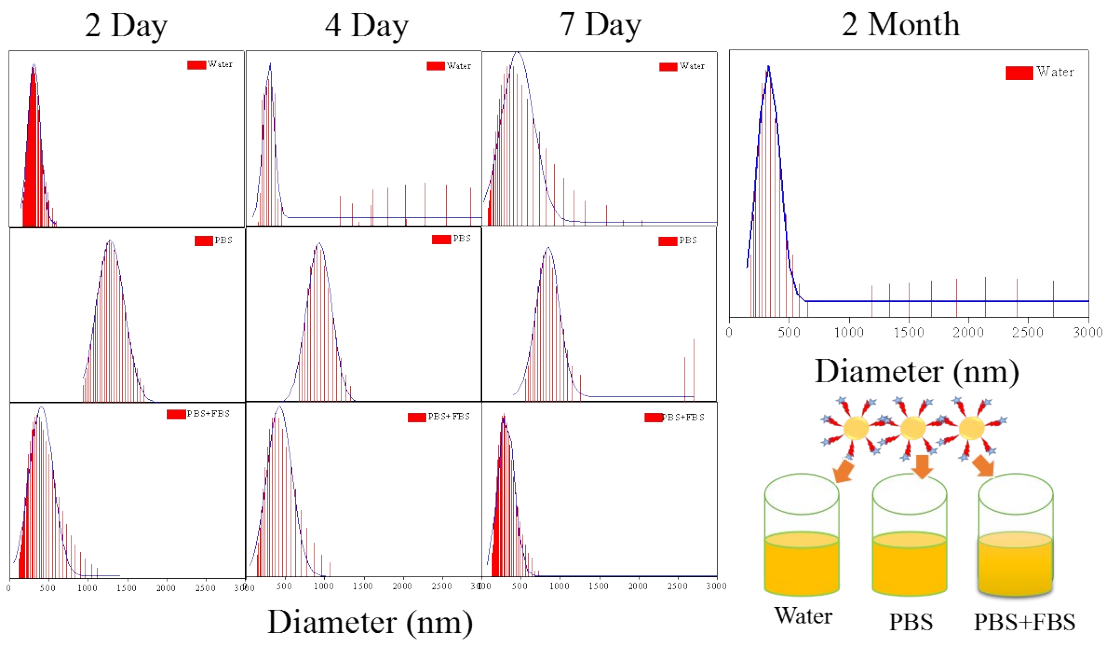

Figure S2. DLS images for LNPs@PEG@GLN which were placed in different solution (water, PBS and PBS+FBS) at different time. Indicated the stability of nanoparticles at different environment.

Table S5. CT value for different organic *in vivo*

Time (min)	**0**	**2**	**5**	**15**
LNPs(liver)	**332.4**	**345.3**	**340.0**	**425.3**

LNPs(spleen)	**262.9**	**255.3**	**337.6**	**528.2**
LNPs(bladder)	**1472.1**	**1564.1**	**1468.2**	**1505.3**
Ioversol(kidney)	**486.0**	**528.0**	**615.5**	**533.5**
Ioversol(bladder)	**332.4**	**1021.2**	**1686.5**	**4620.0**
Ioversol(spleen)	**356.7**	**335.2**	**369.1**	**387.2**

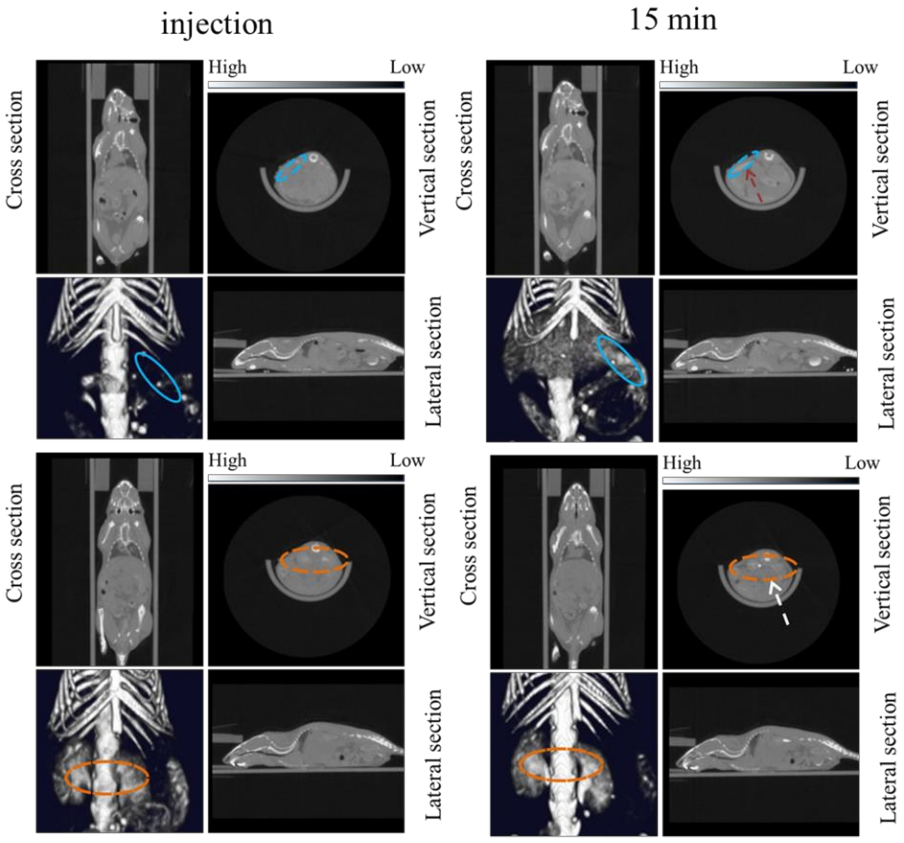

Figure S3. CT 2D flat images before and after injection of LNPs@PEG@GLN (top) and Ioversol (bottom).

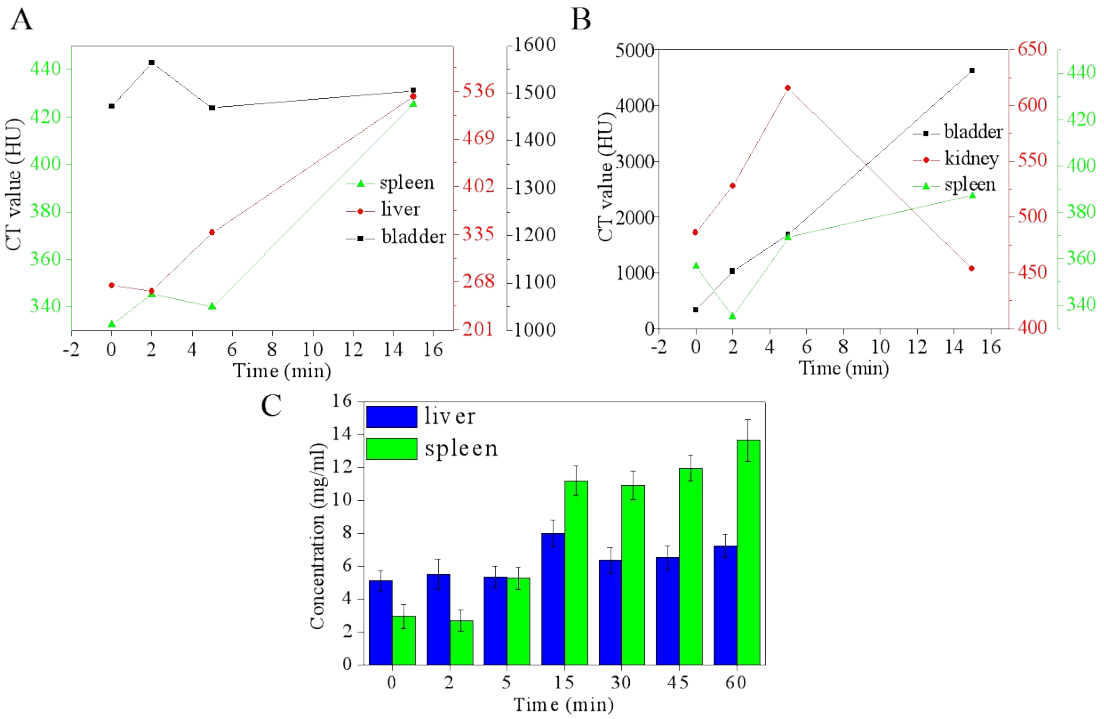

Figure S4 **Bio-distribution of multi-functional LNPs@PEG@GLN.** (A) CT signal of LNPs@PEG@GLN and (B) Ioversol at different tissues at different time respectively. (C) Dose of LNPs@PEG@GLN at different time points. Indicated the distribution of nanoparticles at different tissues.

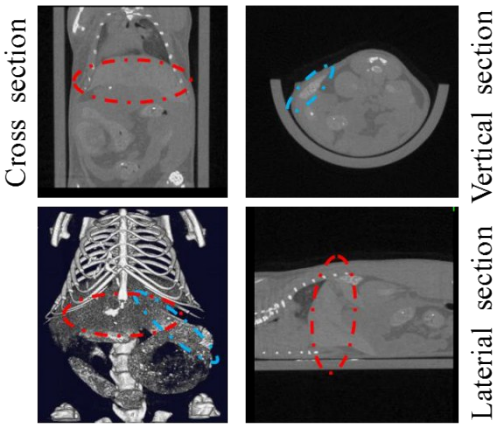

Figure S5. High resolution CT 2D flat images after injection of LNPs@PEG@GLN.

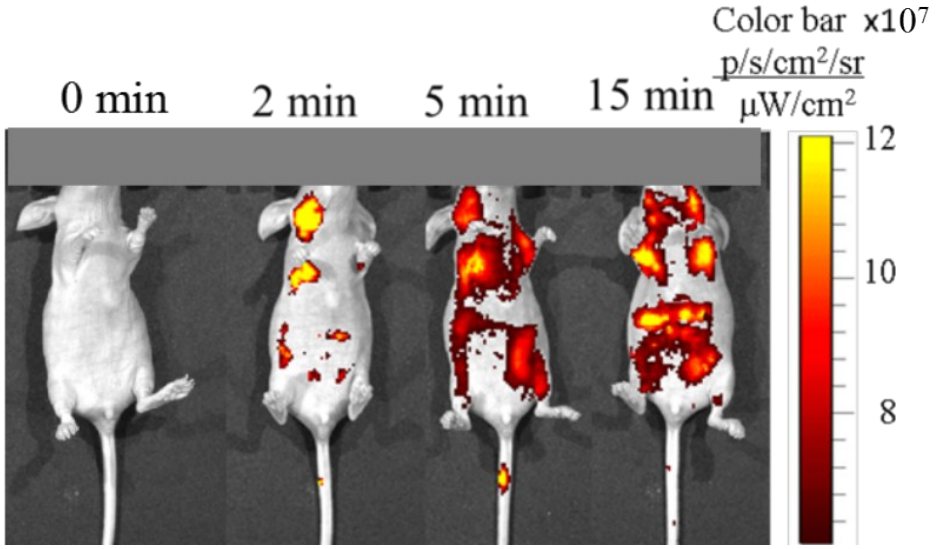

Figure S6 2D fluorescence images at different time points (0 min, 2 min, 5 min, and 15 min) after injection of LNPs@PEG@GLN through the tail vein.

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Movie S: 3D fluorescence imaging animation