Supporting Information

Urokinase loaded black phosphorus nanosheet for sequential thrombolysis and reactive oxygen species scavenging in ischemic stroke treatment

*Dongya Wang,[#a] Qianqian Zhao[#a], Jingcan Qin,[a] Yuanyuan Guo,[a] Chuan Zhang[b] and Yuehua Li[*a]*

[a] Department of Radiology, Shanghai Jiao Tong University Affiliated Sixth People's Hospital, Shanghai Jiao Tong University School of Medicine, 600 Yi Shan Road, Shanghai 200233, China.

[b] School of Chemistry and Chemical Engineering, Frontiers Science Center for Transformative Molecules, and State Key Laboratory of Metal Matrix Composites, Shanghai Jiao Tong University, 800 Dongchuan Road, Shanghai 200240, China.

[#] These authors contributed equally to this work.

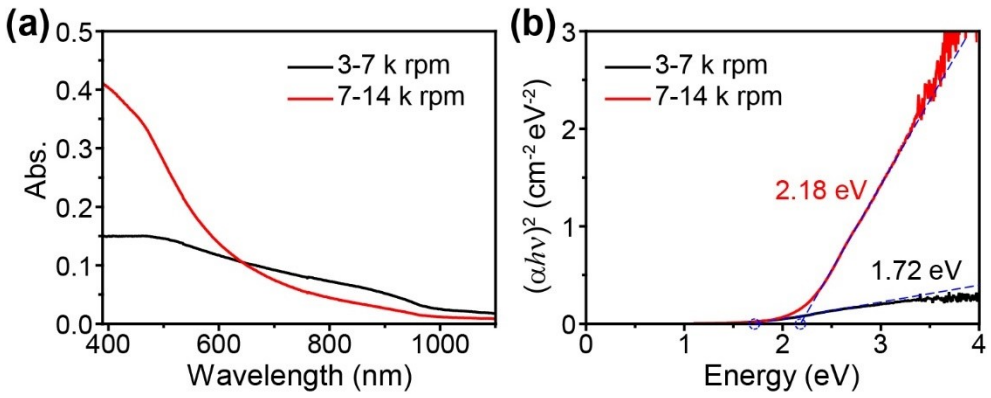

Fig. S1 (a) The absorption spectra of BPN collected with different centrifugation rate. (b) Direct Tauc plots used to determine the optical bandgap. α is the absorbance and $h\nu$ is the photon energy of the incident light.

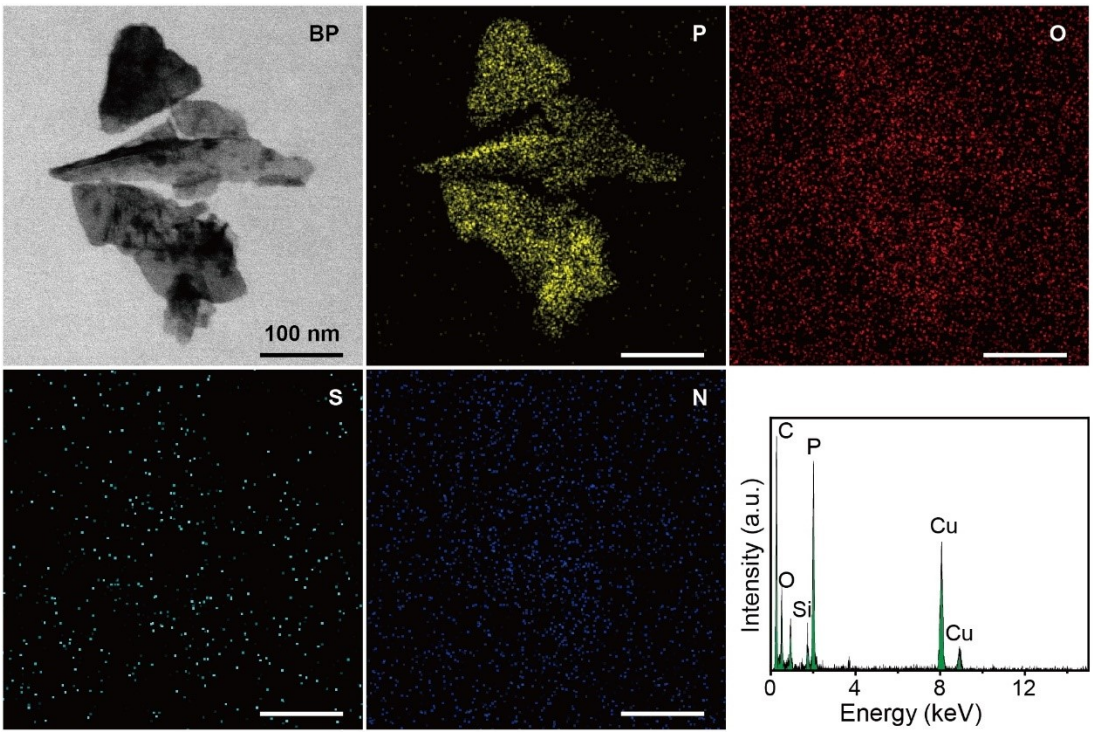

Fig. S2 STEM image of BP and the corresponding EDX elemental mapping and spectrum.

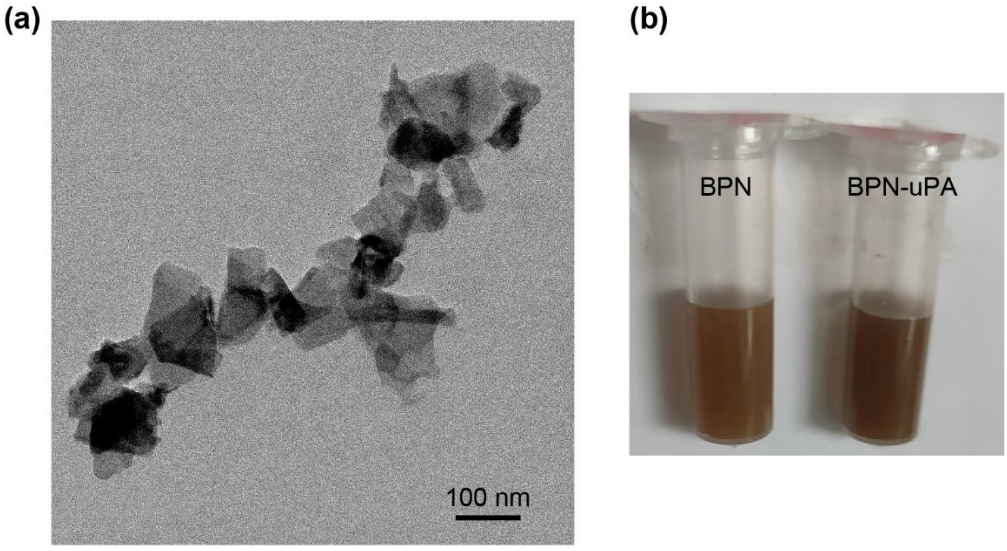

Fig. S3 (a) The TEM image of BPN-uPA. The size of BPN keep constant after loading uPA as the image shows. (b) Photo of BPN and BPN-uPA dispersed in PBS buffer for two hours.

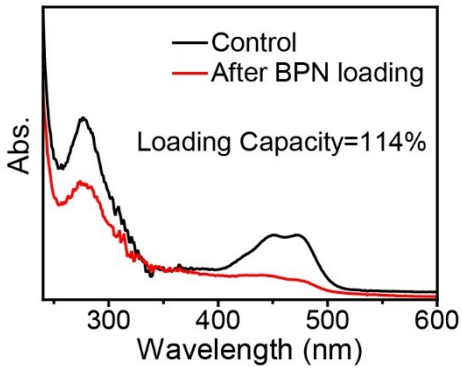

Fig. S4 The absorption spectra of supernatant containing FITC-uPA before and after BPN loading. The decreased absorption intensity at peak 280 nm and 470 nm indicated that the FITC labelled uPA can be still loaded on the BPN. The loading capacity was 114% according to the decrement of absorbance.

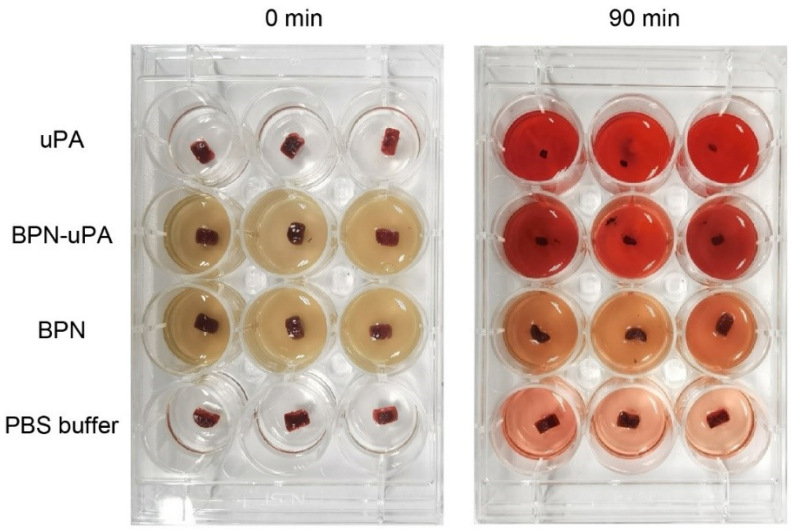

Fig. S5 The digital photographs of thrombi incubated in different solutions at 0 min and 90 min. The presented red color is the result of thrombolysis.

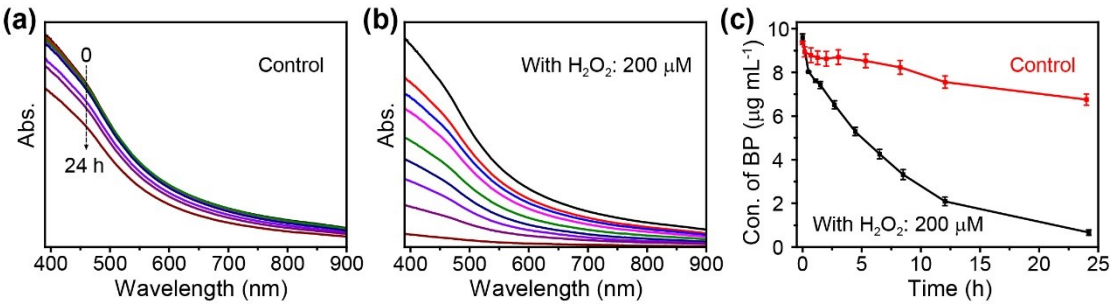

Fig. S6 (a) The absorption spectra of BPN at different time. (b) The absorption spectra of BPN at different time after adding H_2O_2. (c) The corresponding concentration change of BPN.

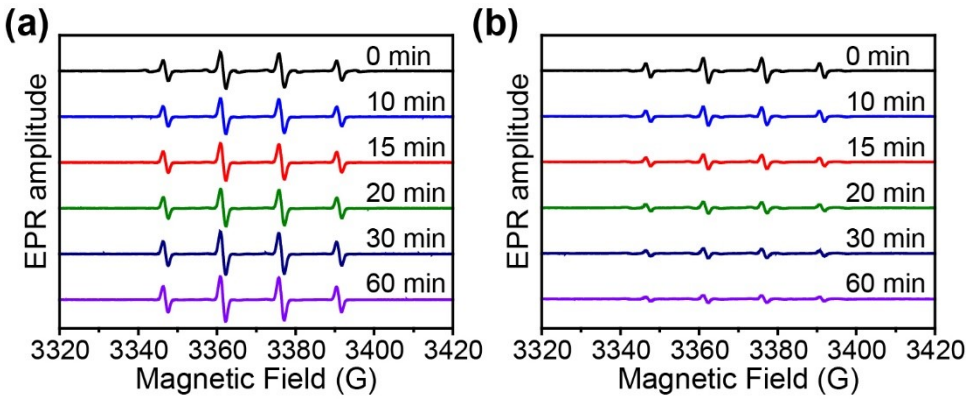

Fig. S7 (a) EPR spectra of Fenton reaction at different reaction time. (b) EPR spectra of BPN contained Fenton reaction at different reaction time. The concentration of BPN in Fenton solution was 10 μg mL^{-1}.

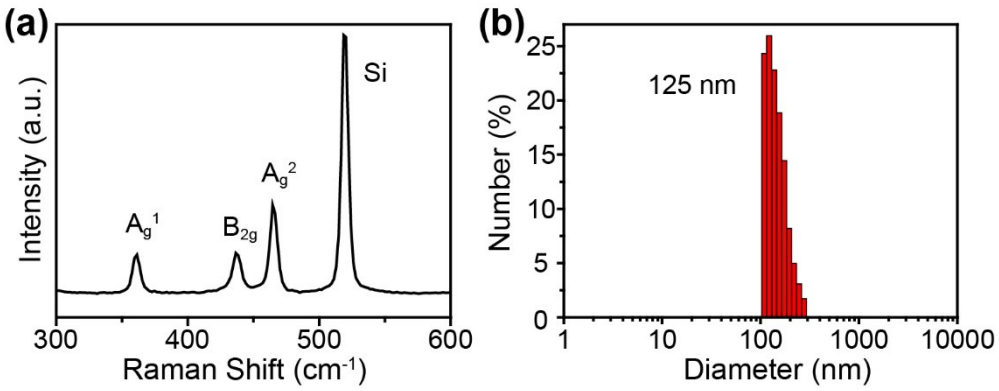

Fig. S8 The Raman spectrum (a) and DLS (b) of the residual BPNs after uPA release from BPN-uPA.

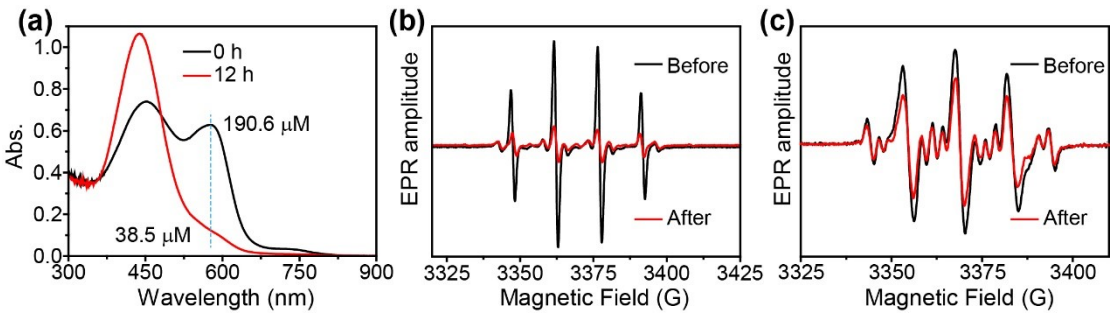

Fig. S9 (a) The absorption spectra of H_2O_2 probe before and after adding the residual BPN after uPA release from BPN-uPA. (b) EPR spectra of •OH radical before and after adding the residual BPN after uPA release from BPN-uPA. (c) EPR spectra of $O_2^{\bullet-}$ radical before and after adding the residual BPNs after uPA release from BPN-uPA.

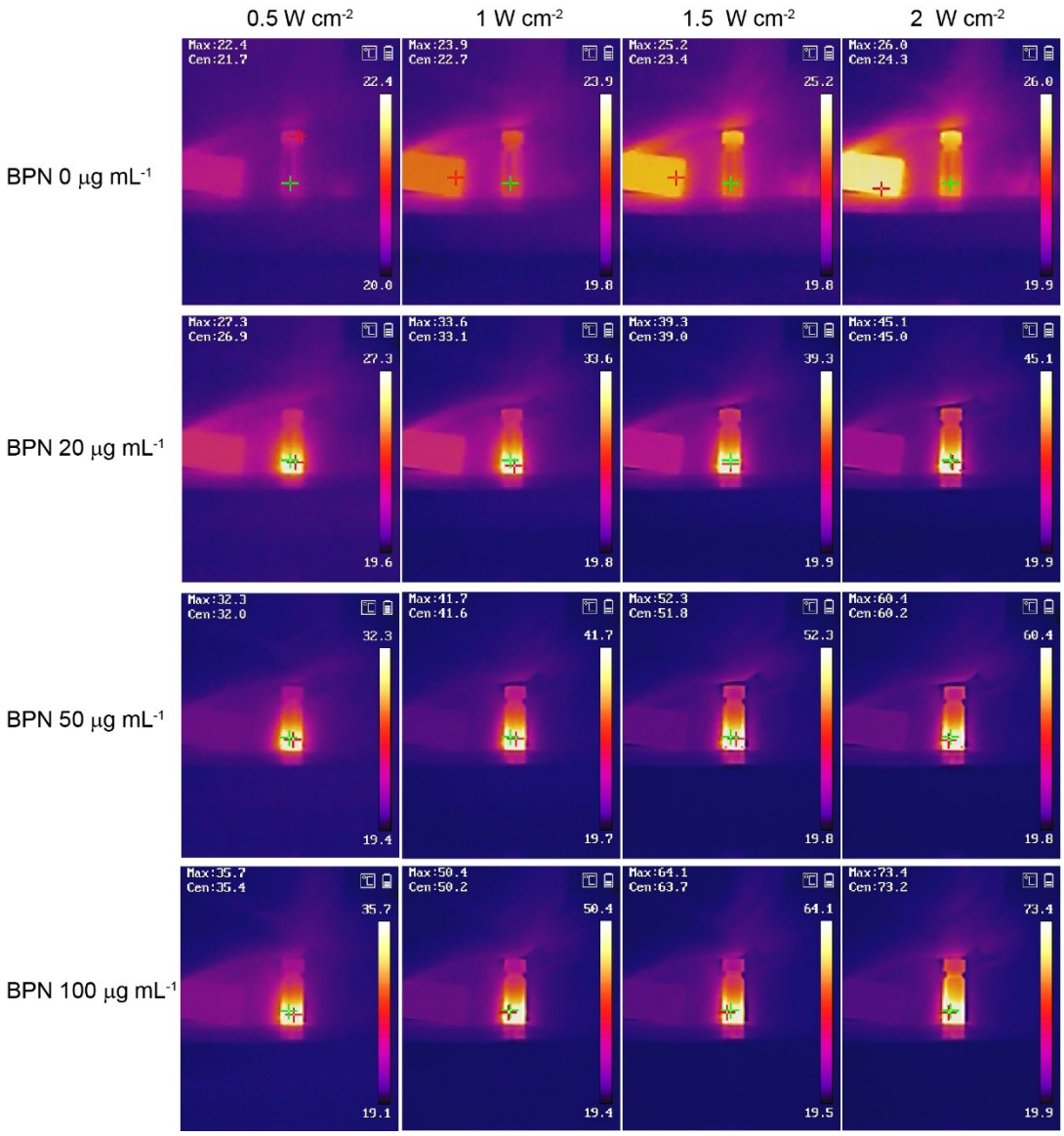

Fig. S10 The thermal images of BPN aqueous (0-100 μg mL^{-1}) in glass bottle after irradiation 10 min at the different power density. The temperature presented as the "Max" in the left-top corner of every image was recorded. The bottle was fixed in a foam box which can stop the loss of heat.

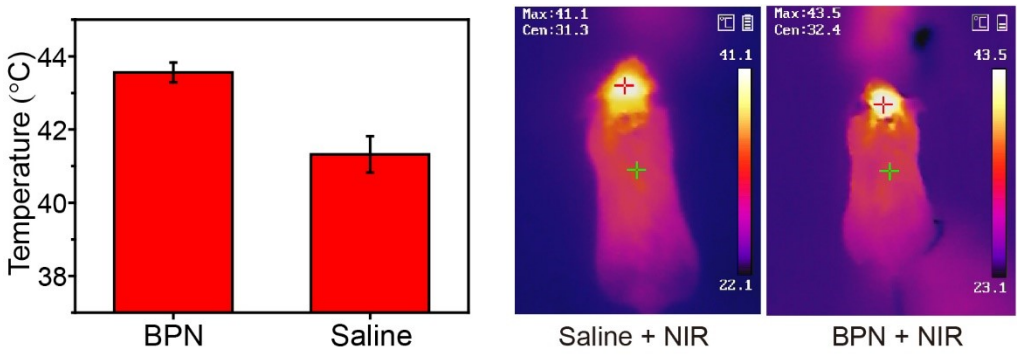

Fig. S11 The temperature statistics of mice head after injected with BPN or saline followed by 808 laser irradiation 3 min at the power density of 2 W cm^{-2} and the representative thermal images.

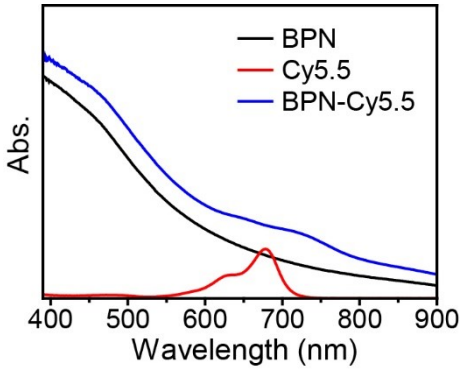

Fig. S12 Absorption spectra of BPN, Cy5.5 and Cy5.5 labelled BPN. The appeared broad peak at the range of 600-800 nm indicates successful modification of Cy5.5.

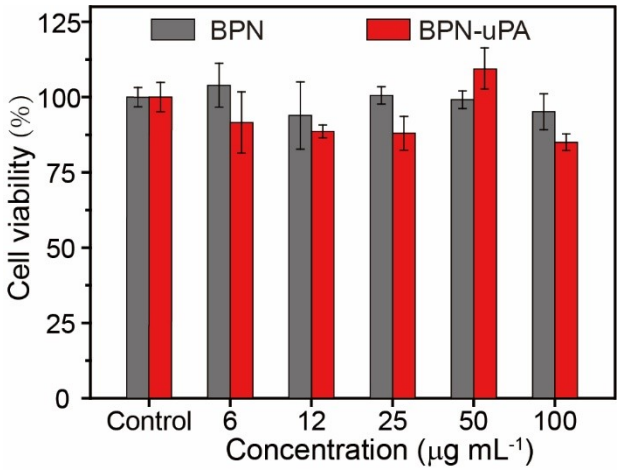

Fig. S13 The cytotoxicity of HUVEC cell with various concentrations of BPN and BPN-uPA after incubation 24 h.

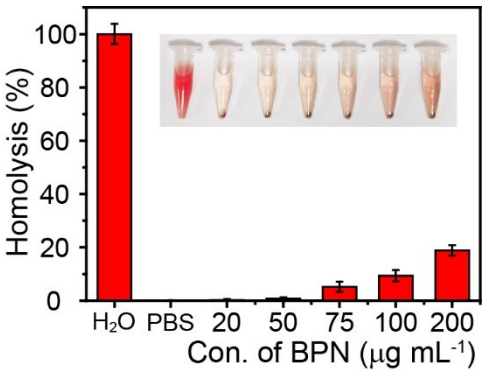

Fig. S14 The hemolysis of red blood cells in deionized water, PBS, and BPN-PBS solution after incubated 6 h. Inset: corresponding digital photo.

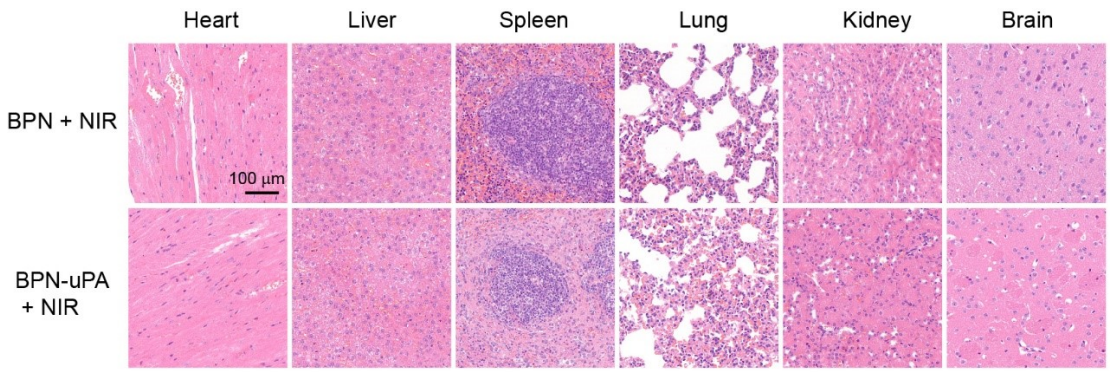

Fig. S15 Representative H&E-stained images of major organs of mice subjected to different treatments.

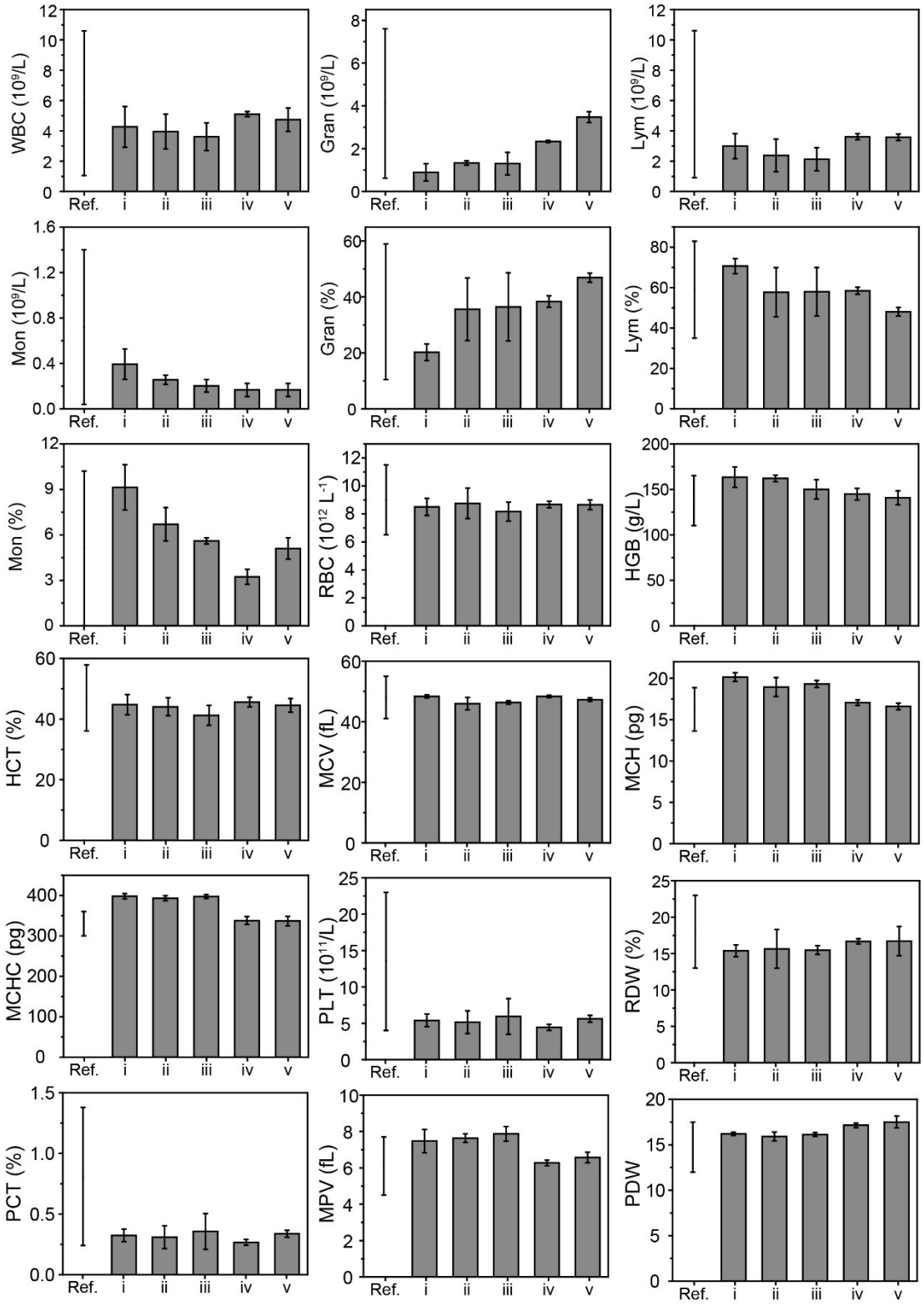

Fig. S16 Blood biochemistry analysis of mice after different treatment (i: control, ii: BPN, iii: BPN-uPA, iv: BPN + NIR, v: BPN-uPA + NIR). All the parameters are commonly in normal range.