Supplementary Information

_N_-Methyl-D-aspartate receptors as novel M1 macrophage-specific biomedical imaging nanoplatform agents: Feasibility of targeted imaging in an inflammatory mice model

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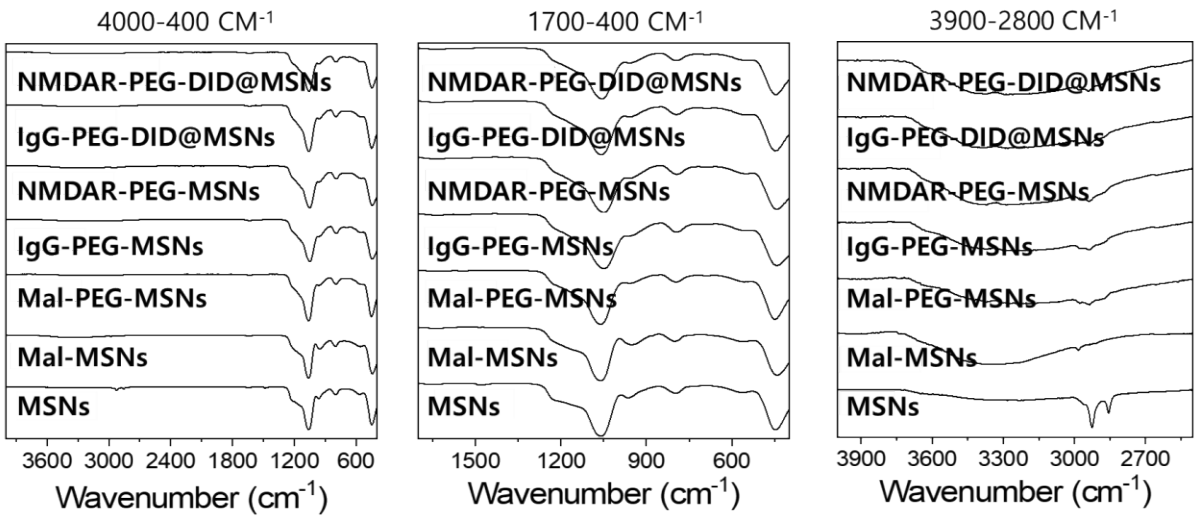
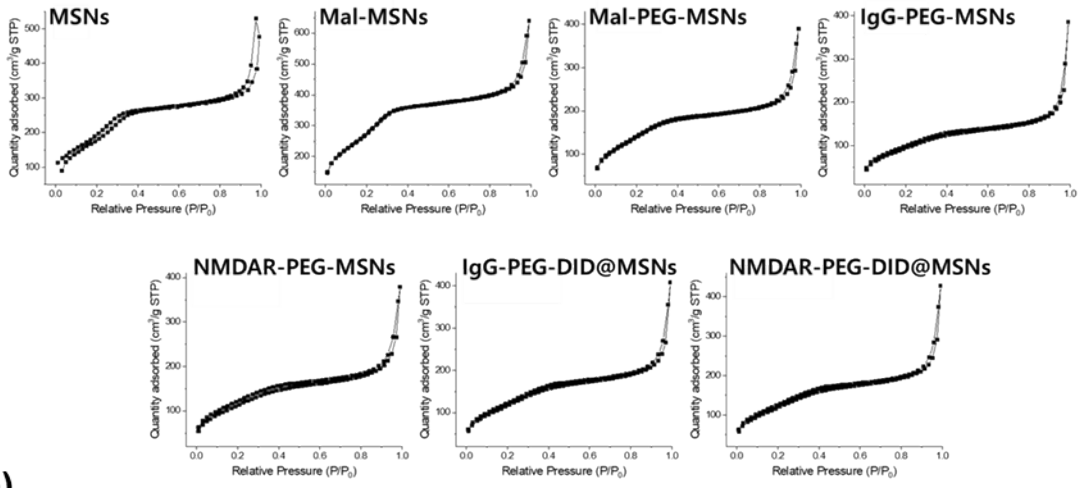


Fig. S1. FT-IR spectra of MSNs, Mal-MSNs, Mal-PEG-MSNs, IgE-PEG-MSNs, NMDAR-PEG-MSNs, IgG-PEG-DID@MSNs, and NMDAR-PEG-DID@MSNs

(a)



(b)

	BET SURFACE AREA (m^2/g)	PORE VOLUME (cm^2/g)	PORE SIZE (Å)
MSNs	671.33	0.81	48.81
Mal-MSNs	994.69	0.98	39.78
Mal-PEG-MSNs	544.28	0.60	44.32
IgG-PEG-MSNs	361.06	0.59	66.20
NMDAR-PEG-MSNs	421.60	0.58	55.65
IgG-PEG-DID@MSNs	434.94	0.49	48.00
NMDAR-PEG-DID@MSNs	448.69	0.46	48.95

Fig. S2. (A) Nitrogen adsorption/desorption isoterms of MSNs, Mal-MSNs, Mal-PEG-MSNs, IgE-PEG-MSNs, NMDAR-PEG-MSNs, IgG-PEG-DID@MSNs, and NMDAR-PEG-DID@MSNs. (B) BJH narrow pore size distribution (based on adsorption branch).

ZETA POTENTIAL

	ZETA POTENTIAL(mV)	CONDUCTIVITY (mS/cm)	STANDARD DEVIATION (mV)
MSNs	-16.2	0.179	6.73
Mal-MSNs	18.4	0.79	9.40
Mal-PEG-MSNs	3.64	0.052	4.13
IgG-PEG-MSNs	23.4	0.89	9.21
NMDAR-PEG-MSNs	24.6	0.84	8.95
IgG-PEG-DID@MSNs	23.4	0.66	6.64
NMDAR-PEG-DID@MSNs	13.2	0.301	8.20

Fig. S3. Zeta-potential of MSNs, Mal-MSNs, Mal-PEG-MSNs, IgE-PEG-MSNs, NMDAR-PEG-MSNs, IgG-PEG-DID@MSNs, and NMDAR-PEG-DID@MSNs.

The introduction of functional groups, such as NH_2 and COOH, would result in the changes of surface of MSNs after reaction step. Therefore, zeta-potential assay was employed to further verify the covalently coupling of various functional groups to MSNs. In contrast to the zeta potential (ζ-potential) of -16.2 mV for Mal-MSNs, the values of zeta-potental for zeta-potential for Mal-PEG-MSNs, IgG-PEG-MSNs, NMDAR-PEG-MSNs, IgG-PEG-DID@MSNs, and NMDAR-PEG-DID@MSNs in 1mM PBS buffer (pH7.2) were correspondingly changed from 18.4 mV, 3.64 mV, 23.4 mV, 24.6 mV, 23.4 mV, to 13.2 mV, respectively. This result suggests that various items/groups were successfully coupled to MSNs.

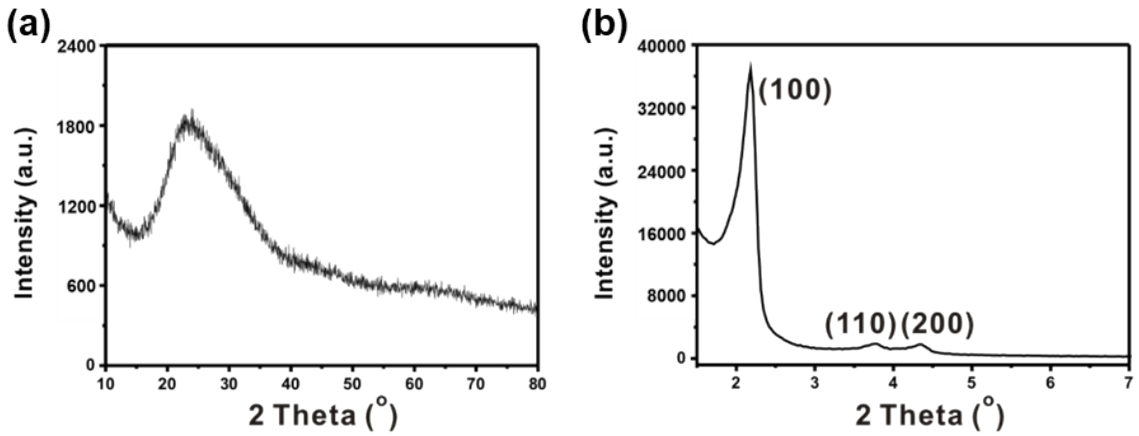


Fig. S4. XRD data of NMDAR-PEG-DID@MSNs. (a) Wide angle XRD (10-80o) XRD patterns. (b) Low-angle XRD (1-6o) XRD patterns. Typical of hexagonal mesoporous silica nanoparticles are shown (100, 110, and 200) in NMDAR-PEG-DID@MSNs

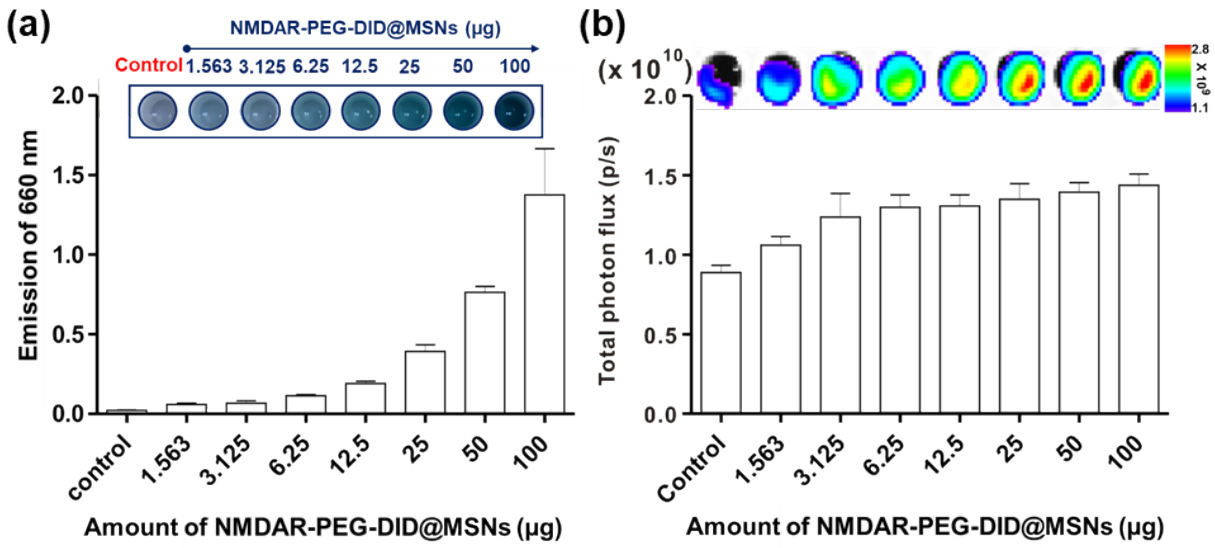


Fig. S5. Sensitivity of NMDAR-PEG-DID@MSNs as a function of concentration (1.5 μg – 100 μg)

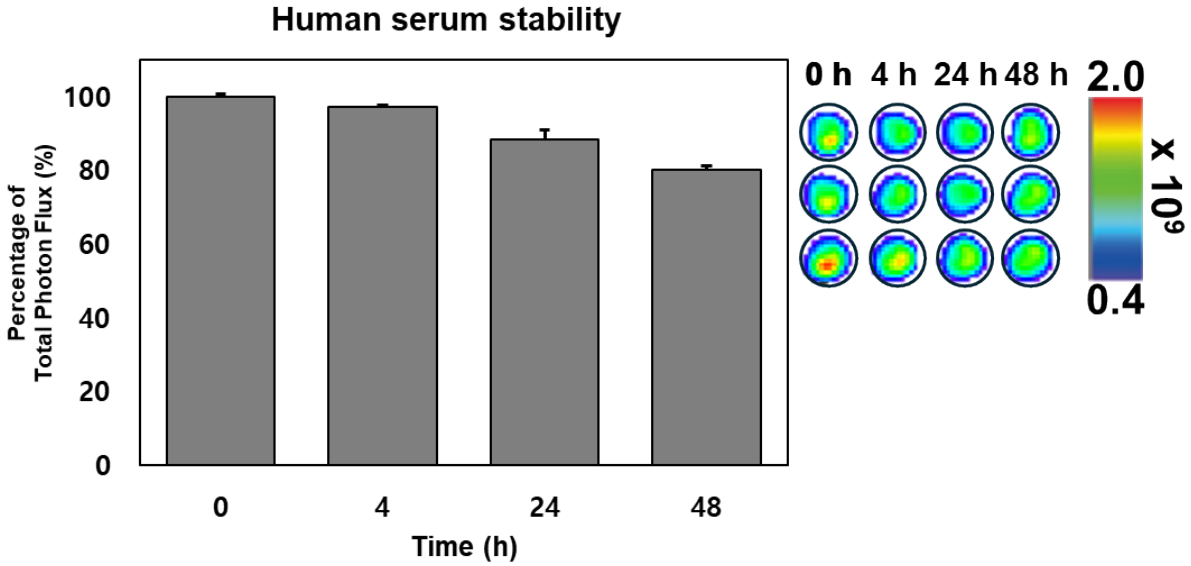


Fig. S6. Stability of NMDAR-PEG-DID@MSNs in human serum though 48 h.

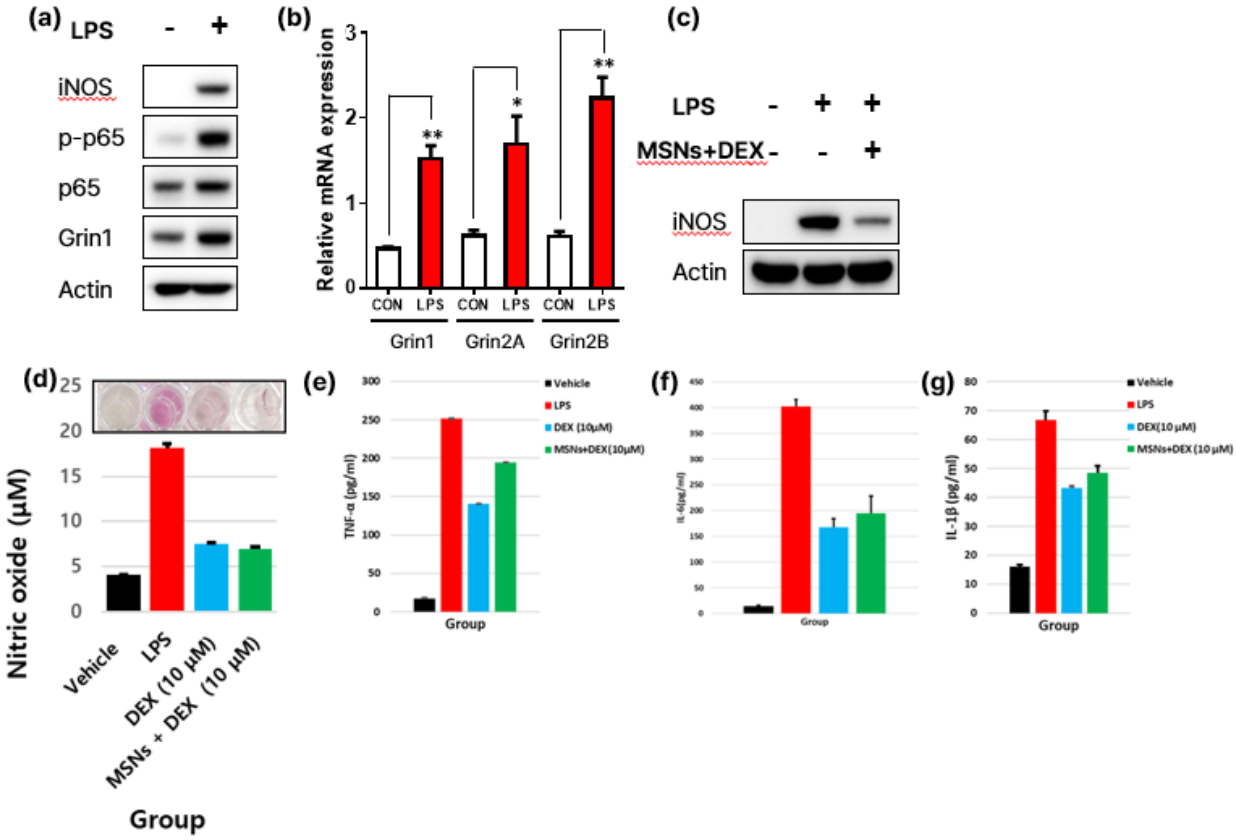


Figure S7. (a) Western blot analysis of iNOS, phosphorylated p65 (p-p65), and Grin1 (NR1) expression in LPS-treated BMDMs for 24 hours. (b) Relative mRNA expression of Grin1, Grin2A, and Grin2B determined by qRT-PCR in LPS-treated BMDMs for 24 hours.(c) Western blot analysis of iNOS expression in LPS-treated BMDMs following treatment with MSNs+DEX (10 μM).(d) Quantification of nitric oxide (NO) production in culture supernatants by Griess assay. (e-g) Levels of TNF-α (e), IL-6 (f), and IL-1β (g) in culture supernatants, measured by ELISA. Data are presented as mean ± SD (n = 3). $p < 0.05$, **p** < 0.01 versus control.

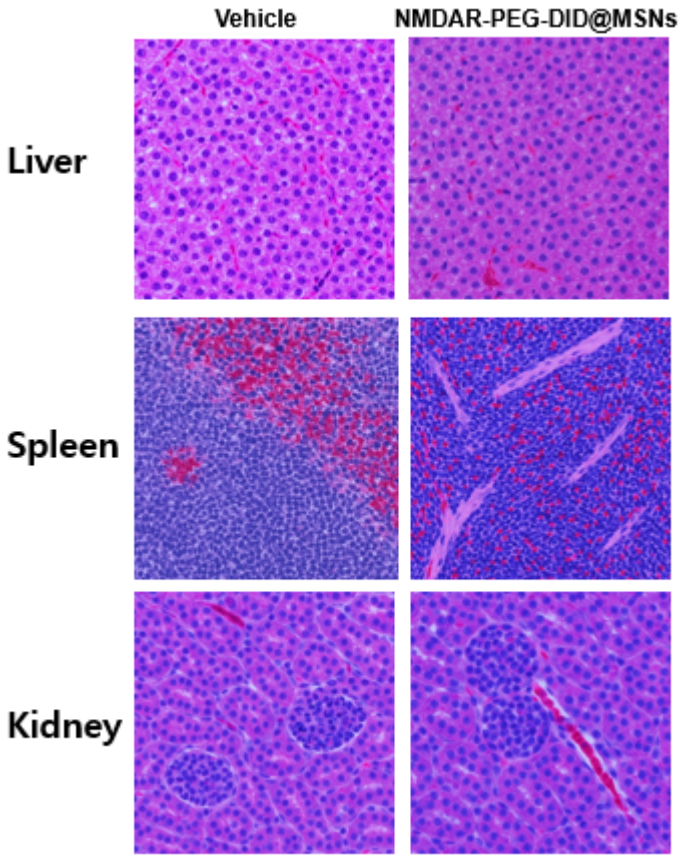


Figure S8. Histological and biochemical evaluations on day 7 revealed no detectable toxicity in the liver, spleen, or kidneys.

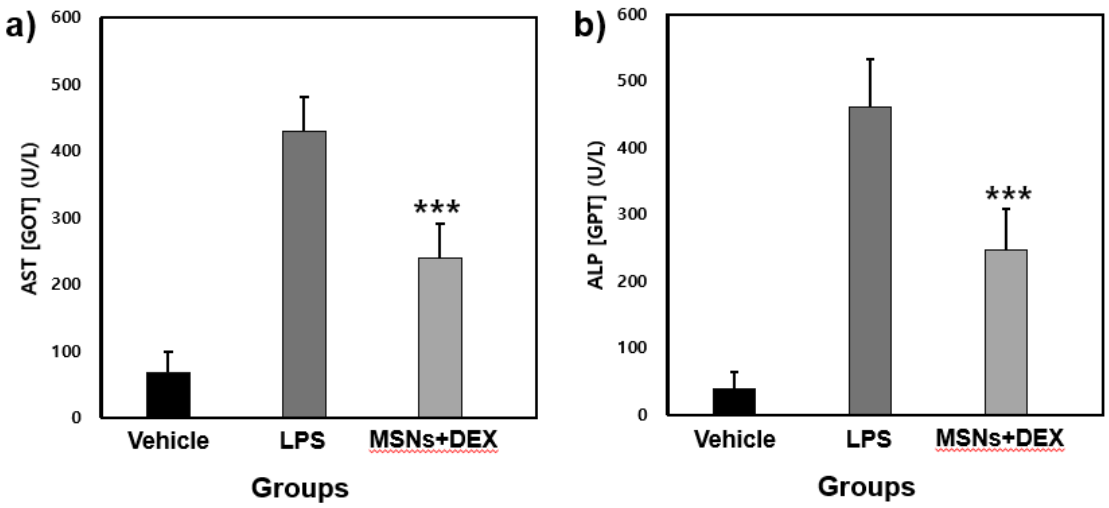


Figure S9. Serum AST (a) and ALP(b) levels following treatment in an acute carrageenan-induced inflammation model.

Serum levels of aspartate Aminotransferase (AST) and Alkaline Phosphatase (ALP) were assessed 24 hours after treatment to evaluate hepatic function and systemic toxicity. Mice were divided into three groups (n = 5 per group): Control, LPS-treated, and MSNs+DEX-treated, following induction of acute inflammation via carrageenan administration. Serum was collected 24 hours post-treatment. The results show no significant hepatotoxicity across the groups, while the MSNs+DEX-treated group demonstrated reduced AST and ALP levels, suggesting potential anti-inflammatory efficacy. Data are presented as mean ± SD