Protective Effect of New Delivery System of Nitric Oxide Releasing Nanofiber in Rat Model of Renal Ischemia-Reperfusion Injury

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BACKGROUND

- Renal ischemia-reperfusion injury (IRI) is very important in various clinical setting including kidney transplantation.
- Nitric oxide (NO) is well known for having various protective effects on cells during IRI. However, there was no way to properly deliver NO to the target organ.
- Recently, S-Nitrosothiol-modified silica/polymer hybrid nanofibers have been introduced as a NO storage and delivery nanoscaffold.
- The aim of this study was to investigate the effect of NO releasing nanofiber in rat model of renal IRI.

METHODS

◆ Subjects

➢ Fifteen male Sprague-Dawley rats were divided into three groups
(1) Sham group (n=5)
(2) Control group, renal IRI without any treatment (n=4)
(3) NO group, renal IRI with wrapping the kidney using NO rapid releasing-polymer nanofiber matrix (n=6)

◆ IRI-Model Experimental Protocol

➢ Right nephrectomy was done one week before renal IRI.
➢ NO releasing sheet was applied by wrapping left kidney one hour before clamp of renal artery.
➢ Renal ischemia was sustained during 55 minutes, followed by reperfusion.
➢ NO sheet was removed after 24 hours. The rats were sacrificed 48 hours after surgery.

RESULT

- To determine the effect of NO on kidney function, we analyzed serum creatinine level. There were significant differences of creatinine between three groups: 0.48 ± 0.08, 4.67 ± 0.33, and 2.60 ± 1.0 respectively (p=0.002).
- We also analyzed markers for inflammation, oxidative stress and apoptosis including ICAM-1, VCAM-1, TNF-α, IL-1b, 6, and 9, NFkb, cleaved caspase 3, Cox-2, iNOS, ED1, and BAX/Bcl-2 ratio in kidney tissue. Most of these markers increased significantly more in the control group as compared with the NO group (p<0.05).
- We then, performed histopathological analysis of kidney tissue. NO group had significantly lower tubulointerstitial injury score than control group (p<0.05)

Figure 1. Body weight and serum creatinine according to the study groups

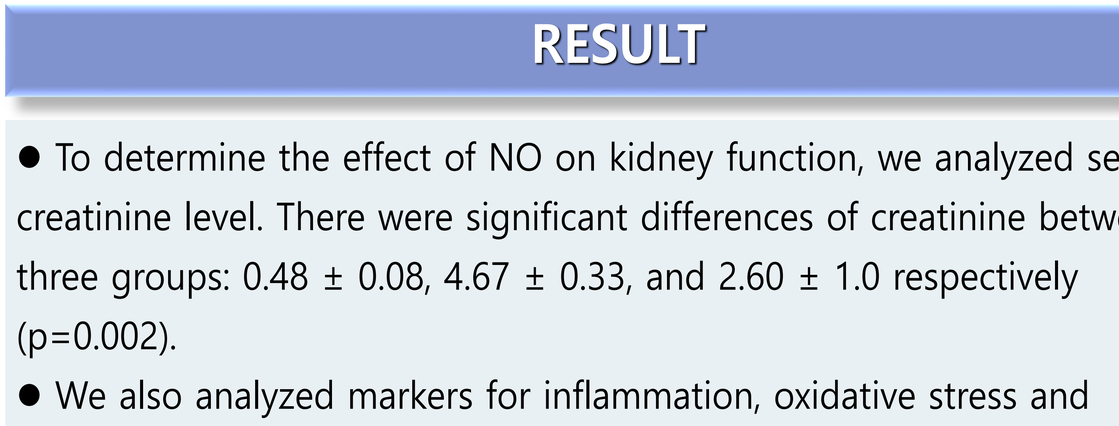


Figure 2. qPCR results of markers for inflammation, oxidative stress and apoptosis in kidney tissues

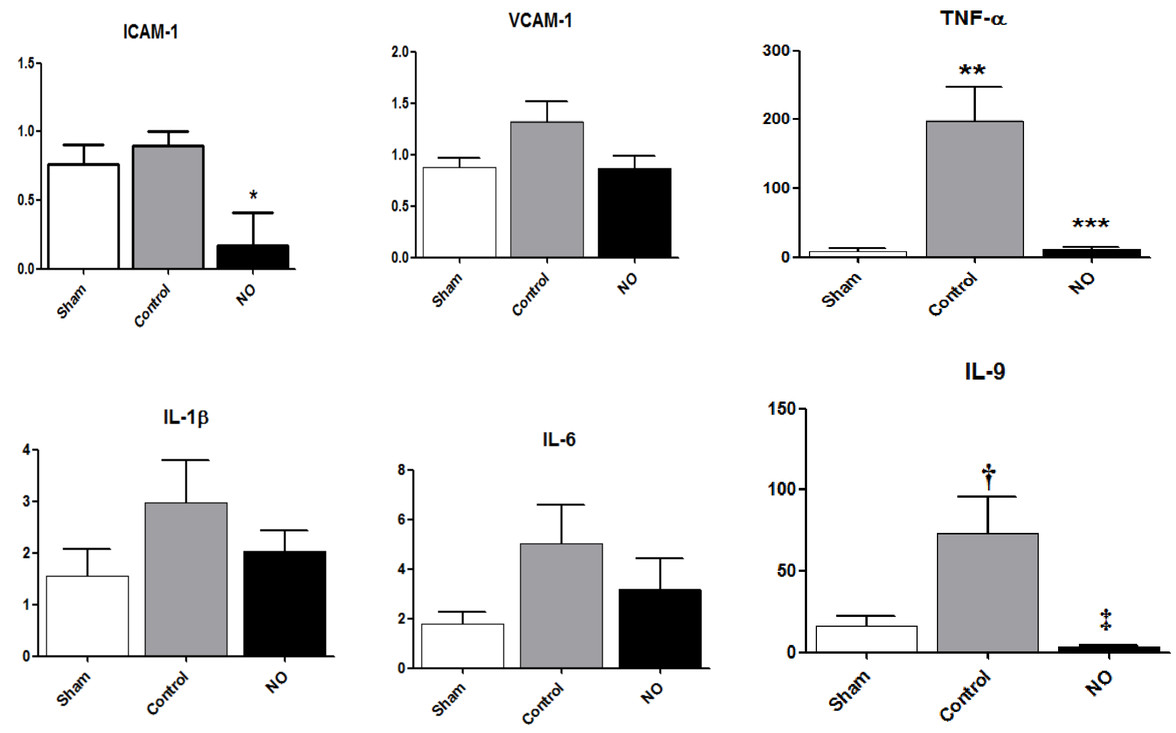


Figure 3. Western blot results of kidney tissues

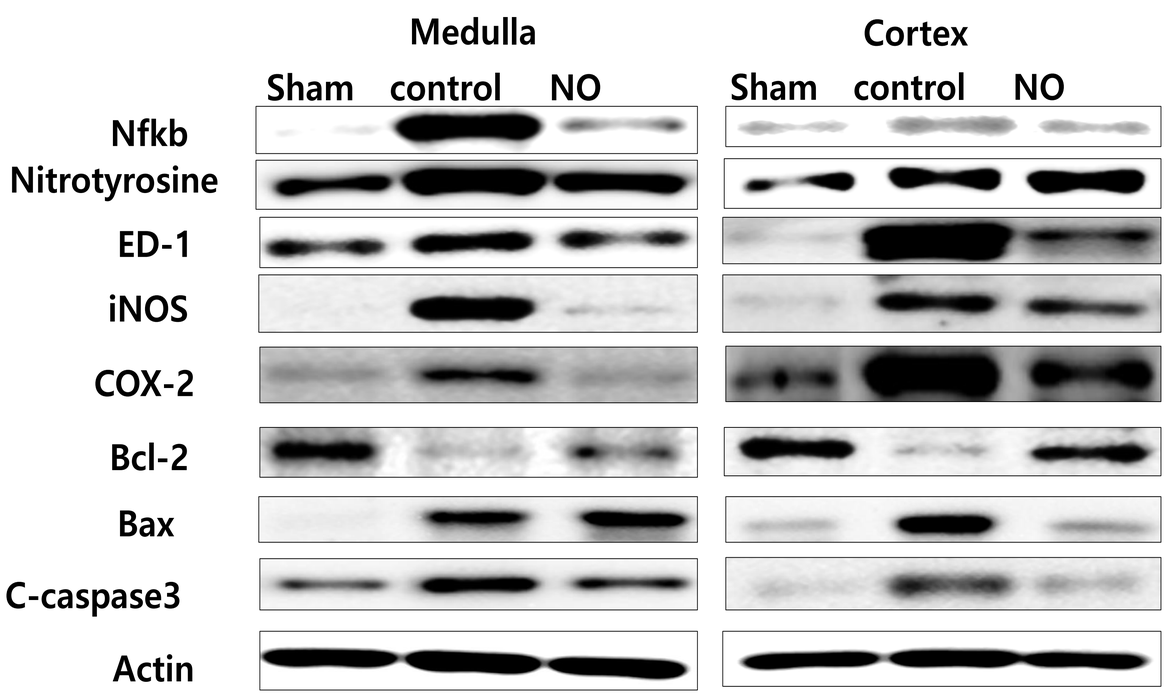
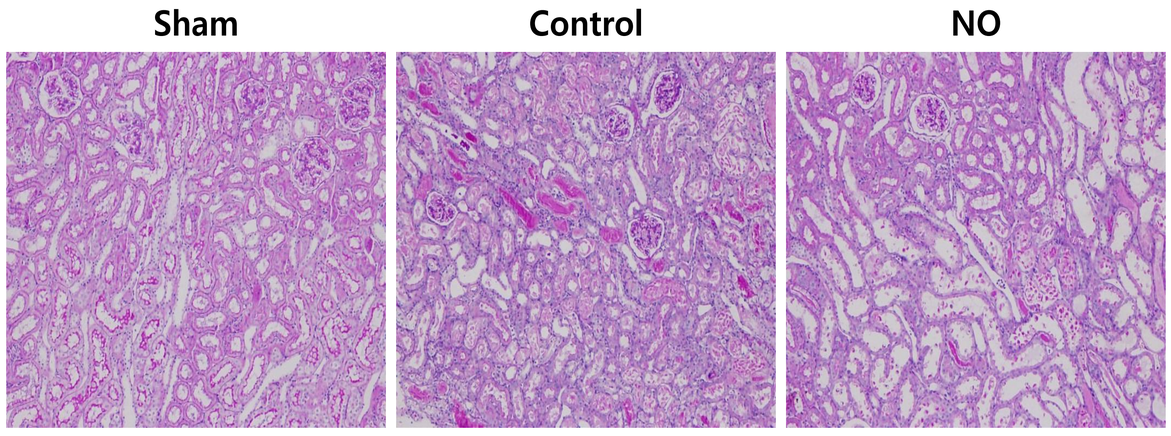
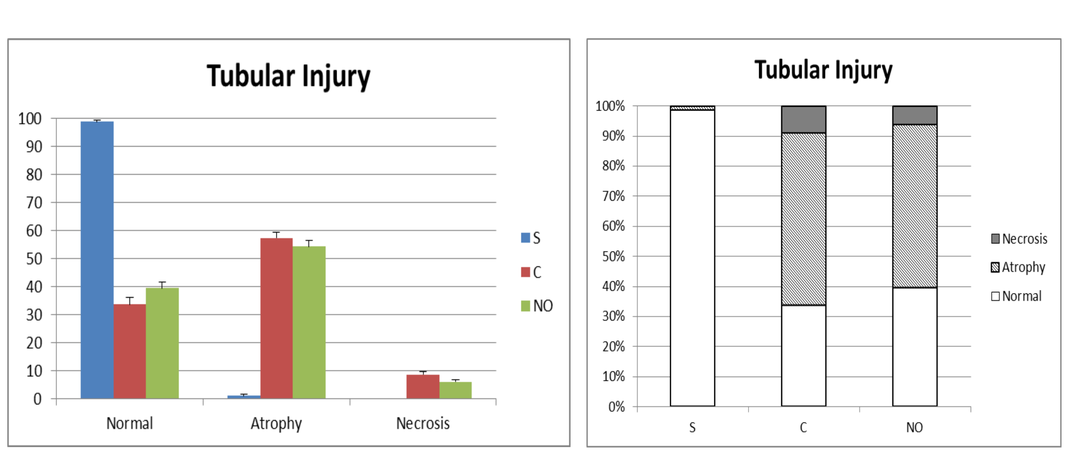


Figure 4. histopathological analysis of kidney tissues according to the study groups





CONCLUSION

- In this study, we demonstrate the protective effect of exogenous NO in renal IRI. This finding might be correlated with inflammation, oxidative stress and apoptosis.
- Furthermore, this new NO delivery system might be considered as a novel method for ameliorating IRI in renal transplantation.

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