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**3D-printed Omentum Patch Transplantation Mitigates Fibrosis in Acute
Kidney Injury to Chronic Kidney Disease Transition**

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Objectives : Recognized for its inherent healing capabilities, the omentum is rich in progenitor cells, growth factors, and angiogenic agents, suggesting a potential role in organ recovery. This study investigates whether omentum patch transplantation can alleviate kidney fibrosis during the transition from acute kidney injury (AKI) to chronic kidney disease (CKD).

Methods : Male C57BL/6 mice, aged 7-8 weeks, underwent unilateral ischemia-reperfusion injury (UIRI) to model the AKI to CKD transition. Utilizing micronized omentum or fibrin as bio-ink, we fabricated 3D-printed patches and transplanted these under the renal capsule in both sham and UIRI groups. Kidney samples were collected at weeks 1 and 5 post-surgery for comprehensive analyses, including single-cell RNA sequencing (scRNA-seq), ultrasound evaluation, and histologic analysis.

Results : Histologic and ultrasound evaluations confirmed that omentum patch transplantation effectively reduced renal fibrosis by week 5, with improvements in cortical thickness and renal indices, suggesting enhanced renal structure integrity in treated mice. scRNA-seq of kidney samples identified 17 cell clusters, highlighting increased survival of proximal tubules, endothelial cells, and Henle's loops in the omentum patch group compared to controls during the first week post-IRI. This group also exhibited reduced inflammatory cell infiltration and lower levels of profibrotic and fibrotic markers (Zeb2, C3, Col3a1) than controls. Notably, TGF-beta pathway activity, associated with fibrosis, was significantly reduced in the omentum patch group.

Conclusions : Transplantation of omentum patches significantly mitigates kidney fibrosis in the AKI to CKD transition model, underscoring the omentum's therapeutic potential for enhancing renal recovery.