



Shaping Tomorrow's Nephrology: Insight-Driven Kidney Care

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Era-Dependent Attenuation of Outcome Disparities in High-Risk Kidney Transplantation Over Five Decades — A Single-Center Experience of 4,024 Cases

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Objectives : Kidney transplantation (KT) has increasingly involved immunologically and medically complex recipients over recent decades. However, whether the historical outcome disadvantage associated with high-risk KT has been attenuated across transplant eras — and whether immunologic and medical risk carry distinct temporal trajectories — remains poorly defined in long-term, large-volume cohort data.

Methods : We retrospectively analyzed KT performed between 1969 and 2025, stratified into four eras (1969-1999 (n = 677), 2000-2009 (n = 675), 2010-2019 (n = 1515), and 2020-2025 (n=1157)). High-risk KT was defined as either immunologic risk (desensitization, panel reactive antibody>50%, HLA 6 mismatch, or anti-thymocyte globulin induction) or medical risk (recipient age≥65 years, diabetes, ischemic heart disease, cerebrovascular disease, or re-transplantation). The primary outcome was death-censored graft survival (DCGS), estimated using Kaplan–Meier analysis, stratified Cox proportional hazards models and Fine-Gray competing risk analysis with death as a competing event.

Results : Both immunologic and medical high-risk KT increased substantially across eras, rising from 0.3% and 4.9% in 1969–1999 to 45.4% and 45.3% in 2020–2025, respectively. Despite this increase, overall DCGS did not deteriorate across the eras. In era-stratified analyses, immunologic high-risk KT was not associated with inferior DCGS in any era (HR range 0.81–2.04; all $p>0.05$). Medical high-risk KT was significantly associated with inferior DCGS in earlier eras (Era 1: HR 1.46 [95% CI 1.01–2.12], $p=0.045$; Era 2: HR 2.54 [95% CI 1.61–4.03], $p<0.001$), but this risk disadvantage was progressively attenuated and was no longer apparent in contemporary eras. Fine-Gray competing risk analyses corroborated these findings (Era 2: sHR 1.80 [95% CI 1.09–2.97], $p=0.022$; Eras 3–4: $p>0.05$).

Conclusions : The outcome disadvantage of medically high-risk KT has been progressively eliminated over five decades, supporting continued expansion of KT to higher-risk candidates.



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