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RECEIVER OPERATING CHARACTERISTIC ANALYSIS OF SINGLE PREDICTORS OF POST-TRANSPLANT OUTCOMES IN KIDNEY TRANSPLANT RECIPIENTS

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Abstract

Accurate prediction of complications and survival after kidney transplantation remains a major clinical challenge due to the multifactorial nature of post-transplant outcomes. According to large registry data, early graft dysfunction, immunological risk, and donor-related factors account for up to 60–70% of early post-transplant adverse outcomes [1,3]. The present study aimed to evaluate the prognostic value of individual biochemical, immunological, and donor-related factors using receiver operating characteristic (ROC) analysis.

ROC analysis demonstrated that when considered individually, all evaluated markers showed low predictive performance, with area under the ROC curve (AUC) values ranging from 0.51 to 0.60. The highest prognostic value among single factors was observed for delayed graft function (DGF), defined as the absence of immediate graft function after transplantation (AUC = 0.60). Moderate predictive ability was noted for panel-reactive antibodies ≥50% (AUC = 0.57), low tacrolimus levels (AUC = 0.56), donor age (AUC = 0.58), kidney donor profile index (KDPI) ≥85 (AUC = 0.56), and acute rejection episodes (AUC = 0.58). Cytomegalovirus infection (AUC = 0.51) and BK virus–associated nephropathy (AUC = 0.53) demonstrated minimal prognostic significance.

These findings confirm that individual markers alone are insufficient for reliable outcome prediction and support the necessity of multifactorial prognostic models integrating multiple clinical and laboratory indicators.

Keywords: Kidney transplantation; survival; ROC analysis; delayed graft function; KDPI; immunological risk; prognosis.

Objective

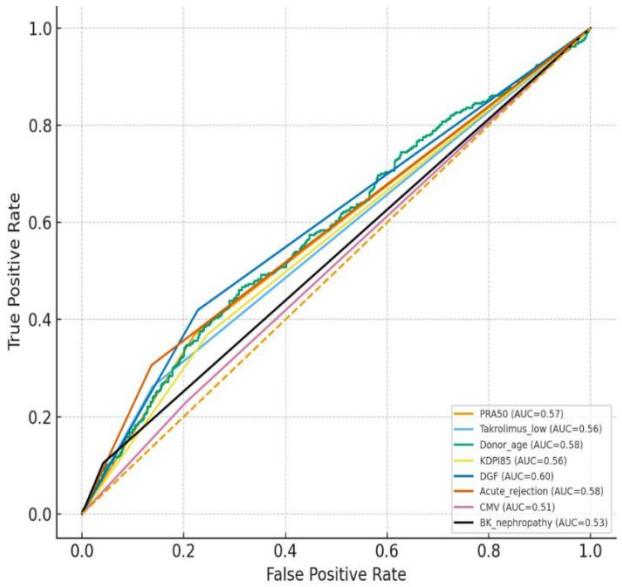
To assess the prognostic value of individual biochemical, immunological, and donor-related factors influencing survival and complications after kidney transplantation using ROC analysis.

Materials and Methods

ROC analysis was performed to evaluate the predictive performance of delayed graft function, panel-reactive antibodies, tacrolimus levels, donor age, kidney donor profile index (KDPI), acute rejection, cytomegalovirus infection, and BK virus–associated nephropathy. Prognostic accuracy was assessed using the area under the ROC curve (AUC). An AUC value of 0.50–0.60 was interpreted as low predictive performance [6,7].

Results

ROC analysis demonstrated that all studied factors exhibited limited prognostic value when analyzed individually (AUC 0.51–0.60). Delayed graft function showed the highest AUC (0.60), which is consistent with published data indicating that DGF increases the risk of graft loss by 40–80% and patient mortality by 30–50% within the first post-transplant year [2].



Moderate predictive performance was observed for immunological and donor-related factors. High panel-reactive antibody levels (≥50%) are reported to increase acute rejection rates up to 35–45%, compared with 15–20% in low-risk recipients [5]. Donor age >60 years and KDPI ≥85 have been associated with a 1.5–2.0-fold increase in graft failure risk [3,4].

In contrast, CMV infection and BK virus nephropathy showed minimal prognostic significance in isolated ROC analysis, which is consistent with literature indicating that their impact on long-term graft survival becomes clinically relevant mainly in combination with immunosuppressive imbalance and reduced graft function [1,3].

Conclusions

1. Individual biochemical, immunological, and donor-related markers demonstrate low prognostic accuracy (AUC 0.51–0.60) when used alone in kidney transplant recipients.
2. Delayed graft function represents the most informative single predictor, increasing the risk of graft failure by up to 80% according to published data.
3. Immunological sensitization and donor-related characteristics provide only moderate predictive value when assessed individually.
4. Reliable prediction of post-transplant outcomes requires multifactorial prognostic models integrating clinical, laboratory, immunological, and donor-related parameters.
5. A comprehensive risk-based approach may significantly improve individualized management and long-term survival after kidney transplantation.

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