EMERGING DIAGNOSTIC PERFORMANCE OF DONOR-SPECIFIC ANTIBODIES AND DONOR-DERIVED CELL-FREE DNA IN SOLID ORGAN TRANSPLANT REJECTION

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Introduction: Monitoring allograft rejection is crucial for improving long-term transplant outcomes, Standard monitoring often fails to detect subclinical injury, leading to irreversible graft loss. Recently, non-invasive biomarkers, specifically donor-derived cell-free DNA (dd-cfDNA) and donor-specific antibodies (DSA), have appeared as accurate tools for early identification of acute and antibody-mediated rejection (AMR).

Material and Methods: We conducted an integrative review of literature indexed in PubMed and Scopus published between 2017 and 2025. The search focused on prospective cohorts and meta-analyses evaluating kidney and heart transplant recipients. Key performance indicators analyzed included Area Under the Receiver Operating Characteristic (AUROC) curves, sensitivity, specificity, and Negative Predictive Value (NPV).

Results: Data synthesis across multiple organ cohorts reveals that dd-cfDNA maintains a diagnostic AUROC range of 0.75–0.86 for identifying allograft injury. Individual kidney studies typically report sensitivity between 59%-82%, with specificity often exceeding 80%. In heart transplantation, sensitivity varies (60–78%), and the NPV remains consistently high at 90–97%, providing a robust "rule-out" capability for acute rejection. DSA positivity was found to be a consistent clinical "red flag", associated with a 2.5 to 4-fold increased risk of AMR. The integration of both biomarkers, using dd-cfDNA to verify the injury suspected by DSA, yielded superior risk stratification than either marker used in isolation.

Conclusions: The evidence from 2017–2025 indicates that dd-cfDNA and DSA are highly complementary. Their integration into clinical practice offers a reliable, non-invasive alternative for identifying early allograft injury. Future efforts should focus on refining organ-specific thresholds to standardize clinical decision-making across diverse transplant populations.

Keywords: organ transplantation, graft survival, delayed graft function, antibodies