EHR-derived marker flags liver transplant recipients at high risk of early death

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Liver transplantation remains the definitive treatment for end-stage liver disease, but early post-transplant mortality continues to challenge clinicians. Identifying patients at highest risk before surgery could guide resource allocation and optimise post-operative care strategies.

A new approach leveraging electronic health record (EHR) data offers a practical, readily available marker to predict 90-day mortality in liver transplant recipients, providing a clear signal for clinicians.

KEY TAKEAWAYS

- The Pivot: A simple, EHR-derived marker, the Red Blood Cell Distribution Width to Platelet Ratio (RPR), effectively stratifies liver transplant recipients by 90-day mortality risk.
- The Data: Patients with a high RPR (defined as >0.07) had a significantly increased risk of 90-day mortality (HR 2.87; 95% CI, 2.11-3.90; PThe Action: Consider incorporating RPR into pre-transplant risk assessments to identify patients who may benefit from enhanced monitoring or targeted interventions.

Early mortality following liver transplantation, particularly within the first 90 days, represents a critical period for patient outcomes. Clinicians have long sought reliable, easily accessible biomarkers to identify individuals at elevated risk, allowing for proactive interventions. Current risk scores, while useful, often rely on complex calculations or data not routinely available at the point of care. This gap leaves room for a simpler, more integrated approach to risk stratification. Investigators explored the utility of the Red Blood Cell Distribution Width to Platelet Ratio (RPR), a metric derived from routine complete blood count (CBC) data, as a predictor of early post-transplant mortality. The RPR combines two readily available parameters: red cell distribution width (RDW), a measure of erythrocyte size variability, and platelet count, a marker of liver synthetic function and inflammation. The study retrospectively analysed a cohort of 1,500 adult patients who underwent liver transplantation at a single academic centre between 2005 and 2018. The primary endpoint was 90-day all-cause mortality, with secondary endpoints including 1-year mortality and incidence of major post-operative complications such as acute kidney injury and infection. All data for RPR calculation were extracted from pre-transplant EHRs, specifically within 48 hours prior to surgery.

The RPR as a prognostic tool

The RPR effectively stratified patients into distinct risk groups for 90-day mortality. Patients with a pre-transplant RPR greater than 0.07 demonstrated a significantly higher risk of death within 90 days compared to those with an RPR of 0.07 or less (HR 2.87; 95% CI, 2.11-3.90; P1.98; 95% CI, 1.55-2.53; PBreaking down the components, both elevated RDW and decreased platelet count independently correlated with poorer outcomes, but their ratio provided a more

robust predictive signal. An RDW above 14.5% (the upper limit of normal) and a platelet count below 100 x 109/L are individually recognised as markers of chronic inflammation and advanced liver disease, respectively. The RPR integrates these two markers, reflecting a composite picture of systemic inflammation, nutritional status, and portal hypertension, all of which contribute to post-transplant complications. The investigators proposed that a higher RPR indicates a more severe inflammatory state and poorer physiological reserve, making patients less resilient to the surgical stress and immunosuppression inherent in transplantation.

The study also examined the RPR's association with post-operative complications. Patients in the high RPR group experienced higher rates of acute kidney injury requiring renal replacement therapy (23% vs 11%; P=.003) and severe infections (35% vs 20%; P=.005) within the first 30 days post-transplant. These complications directly contribute to early mortality and highlight potential areas for targeted pre-emptive strategies. For instance, patients identified with a high RPR might benefit from more aggressive pre-transplant optimisation of nutritional status, closer monitoring for infection, or enhanced perioperative renal protection protocols.

Where it falls short

The retrospective nature of the study is an obvious caveat. While the large cohort size and robust statistical adjustments mitigate some concerns, a prospective validation study is essential to confirm these findings. The single-centre design also limits generalisability; patient populations and clinical practices vary significantly across transplant centres. The RPR was calculated using pre-transplant data, but the optimal timing for this measurement, and whether serial measurements could offer additional prognostic value, remains an open question. The study did not explore the impact of specific immunosuppression regimens or the aetiology of liver disease on the RPR's predictive power, which could be relevant confounding factors. Furthermore, the RPR is a non-specific marker, and while it correlates with inflammation and liver dysfunction, it does not elucidate the precise pathophysiological mechanisms driving increased mortality in these patients. Future research should aim to integrate RPR with other established biomarkers and clinical scores to develop a more comprehensive risk assessment model.

Still, the simplicity of the RPR is its strength. It requires no additional tests or complex calculations, making it readily implementable in any centre with EHR access. This accessibility means it could be integrated into existing pre-transplant evaluation algorithms with minimal disruption. For clinicians seeking a quick reference for general medical conditions, the Oxford Handbook of Clinical Medicine (11th ed) offers a concise bedside guide.

CLINICAL IMPLICATIONS

The RPR offers a straightforward, accessible tool for risk stratification in liver transplant candidates. Its derivation from routine blood work means no additional costs or delays in an already complex evaluation process. Clinicians can integrate this marker into their pre-transplant assessments to identify patients who may require more intensive perioperative management or closer post-operative surveillance.

For transplant centres, a high RPR could trigger a review of a patient's suitability for transplantation or prompt a discussion about the potential need for enhanced post-operative resources, such as extended ICU stays or more aggressive infection prophylaxis. This could lead to more efficient allocation of scarce resources and potentially improve overall outcomes for a vulnerable patient population.

But the RPR is not a standalone decision-making tool. It should complement, not replace, existing

> comprehensive clinical assessments and established risk scores like the MELD score. Its value lies in providing an additional, easily obtainable piece of the prognostic puzzle, particularly in settings where more advanced biomarkers are not routinely available.
> The next step involves prospective validation in diverse patient cohorts across multiple centres. Only then can the RPR move from an interesting retrospective observation to a widely adopted clinical standard, truly informing patient selection and management strategies in liver transplantation.

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