

The Sentinel Flap: A Visible Canvas for Organ Transplant Care

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Transplantation remains the treatment of choice for end-stage organ failure, restoring both survival and quality of life. Yet despite advances in immunosuppression, rejection remains the principal threat to long-term graft survival. Rejection is common across organ types, clinically heterogeneous and often detected only after irreversible graft injury has occurred. Current surveillance strategies include intermittent serum biomarkers, organ-specific functional tests and protocol or for-cause biopsies. These modalities remain episodic, invasive, and fundamentally reactive. They provide only a narrow snapshot of a continuously evolving alloimmune response and fail to capture the earliest phases of immune activation.

No validated biomarker in routine practice reliably predicts impending rejection. Newer molecular assays including gene-expression panels and donor-derived cell-free DNA have generated considerable interest but their signals often emerge late, are confounded by infection or non-specific inflammation and may be less informative in rapidly evolving rejection syndromes. Clinicians often face a diagnostic grey zone at the very time when early recognition could preserve graft function, avoid high-dose rescue therapy, and improve long-term outcomes. This persistent gap highlights the need for a visible, real-time, patient-centred immunosurveillance tool capable of detecting alloimmune activation before biochemical or histological injury becomes established.

Such an approach is particularly valuable when timely diagnosis is difficult and diagnostic biopsies carry inherent risk for both transplant and patient.¹ The sentinel skin flap (SSF) takes advantage of the immunogenicity and visibility of skin to act as a dynamic “canvas” for immune activity, enabling real-time monitoring and earlier recognition of rejection in the visceral graft before clinical signs appear in the transplanted organ. The SSF consists of a small vascularised patch of donor skin co-transplanted with the solid organ and inset into the recipient's forearm, where it functions as a highly accessible, “living biopsy”, reflecting the same alloimmune processes occurring within the concealed transplanted organ.² Patients can

be educated to observe for signs such as rash, erythema, swelling, and induration, which may prompt a painless skin biopsy to diagnose rejection, potentially preceding clinical, biochemical, or histological evidence of allograft injury. Early feasibility data from the Oxford group demonstrate statistically significant advantages in intestinal transplant survival (79% vs 60%), intestinal rejection rate (7% vs 27%) and misdiagnosis of infection as rejection (14% vs 33%) in patients receiving organ transplant plus abdominal wall (n = 13) in comparison to those receiving organ transplant alone (n = 15).³

While the accessibility and visibility of the SSF make it a uniquely patient-led innovation, these features also pose inherent challenges, particularly from psychosocial, cosmetic, cultural, and ethical perspectives. Successful integration of the SSF in post-transplant care is reliant on careful evaluation of the perspectives and attitudes of the Irish transplant population. As a result, Patient and Public Involvement (PPI) was prioritised from the outset of the pre-clinical and clinical phases of the SSF programme in Ireland. Feasibility studies are ongoing to understand patient responses to the SSF and refine it in line with patient priorities.

Ireland is uniquely positioned to explore this innovation. Transplant activity is centralised in Dublin, with kidney transplantation at Beaumont Hospital; liver and pancreas transplantation at St Vincent's University Hospital; and heart and lung transplantation at the Mater Misericordiae University Hospital. All programmes operate under the national coordination of HSE Organ Donation and Transplant Ireland (ODTI). This integrated national model enables cohesive protocols, close interdisciplinary collaboration and rapid standardisation, creating a favourable environment for the safe evaluation and adoption of new transplant innovations such as the SSF. Strong academic-clinical partnerships, supported by Clinical Research Centres (CRCs), ensure that research governance and capacity are embedded within care pathways, while centralisation across a manageable patient population enables rapid and standardised adoption of new techniques. The scale of the Irish system provides both feasibility and agility: small enough for close monitoring, yet large enough to generate meaningful early experience. The planned introduction of the SSF also aligns with emerging national clinical trials policy, which seeks to streamline governance, strengthen research infrastructure, and enable complex translational studies such as the SENTINEL Trial.⁴

Another key strength of the Irish system as a testing ground for the SSF is the growing interest and investment in digital health. A core aim of the national eHealth strategy is to develop innovative, patient-centred digital platforms that will help overcome geographical barriers to care. Piloting the SSF in Ireland offers opportunities to expand eHealth tools that could transform routine follow-up. These may include developing a secure platform for patients to photograph their flap at home for remote review, supported by artificial intelligence to detect subtle colour or texture changes preceding overt rejection. Such approaches reduce hospital visits, particularly for those outside Dublin, and align with Ireland's broader ambition to develop innovative, patient-centred digital healthcare.

Early and continuous stakeholder engagement has emerged as a critical pillar for successful implementation of the SSF programme in Ireland. Findings from a national stakeholder survey involving surgeons, transplant physicians, anaesthesiologists, ICU teams, ODTI staff, nurses, managers, and laboratory specialists revealed consistent system-level priorities and concerns. Participants emphasised that translational innovation is contingent upon visible institutional backing, protected research time and clear governance—particularly around ethics, data protection, and biomaterial transfer processes. Concerns regarding workload, feasibility, and reputational risk were highlighted across administrative and clinical groups, reinforcing the need for clear expectations and inclusive communication from the outset. Importantly, patient benefit remained the strongest motivator, with stakeholders expressing genuine enthusiasm for innovations capable of improving graft outcomes. These findings underscore that robust early engagement is not ancillary but foundational to the adoption, acceptability, and sustainability of complex translational innovations such as the SSF.⁵

By shifting surveillance from laboratory-driven, episodic monitoring to a visible, patient-centred biomarker, the SSF reframes graft monitoring around patient empowerment and earlier intervention. Ireland's centralised transplant infrastructure and digital readiness make it an ideal setting in which to assess the feasibility of this innovative technique, which could shape international transplant standards. We look forward to delivering the results of the SENTINEL Trial.

Declarations of Conflicts of Interest:

None declared.

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