



Innovations in Renal Replacement Technology and Their Impact on the Risk of Renal Cancer in Kidney Transplant Patients

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ABSTRACT

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Introduction: The current standard of care for patients with end-stage renal disease (ESRD) is a kidney transplant, and when a donor organ is not available, patients undergo long-term dialysis. There is a growing gap between patients who require a kidney transplant and the availability of donor organs. Dialysis is more widely available, but does not replace full kidney functionality, leading to worse outcomes. The past 20 years have seen an increase in alternative renal replacement technology in an effort to address the aforementioned issues with current therapies. The risk of kidney cancer in kidney transplant patients is increased when compared with the general population; the risk is hypothesized to be most closely tied to immunosuppression after the transplant surgery and length of time on dialysis. Given the increased risk of kidney cancer associated with kidney transplantation, it is imperative to assess the capabilities of these new devices not only for their functionality as alternatives to a donor organ, but also their potential to reduce the risk of renal cancer in this patient population.

Purpose: The purpose of this review is to assess the technological potential of the most recent advancements in renal replacement technology in reducing risk of renal cancer in ESRD patients who require kidney transplantation.

Methods: We performed a PubMed database search in July-August 2020 with the following search terms: [artificial kidney], [wearable artificial kidney], [bioartificial kidney], [implantable bioartificial kidney], [kidney regeneration]. These search terms were used to identify publications about the recent innovations in kidney replacement technology. Each technology was analyzed for its ability to replace total kidney functionality as well as its potential to reduce the risk of renal cancer. The potential to reduce risk of renal cancer was assessed by the device's impact on immunosuppression and dialysis timeframes.

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Results: Four of the newest innovations in renal replacement technology were identified and analyzed: the wearable artificial kidney (WAK), the automated wearable artificial kidney (AWAK), the implantable bioartificial kidney (IAK), and kidney regeneration technology. Of these innovations, the IAK and kidney regeneration technology were found to have the most promise in reducing the risk of renal cancer in ESRD patients requiring transplantation.

Conclusions: With the volume of new medical devices and technologies rising every year, it is imperative to analyze the impact they have on patient outcomes. A new technology should be assessed to determine if it improves on a limitation of prior solutions. In this study, we identified two devices with the potential to reduce the occurrence of a major risk associated with patients requiring kidney transplantation: renal cancer. Additional studies are required to analyze these devices once they move into the human clinical trial testing phase.



Figure 1 Implantable Bio-artificial Kidney: Prototype of the device components.

	INCREASES # OF ALTERNATIVES TO TRANSPLANT	PATIENT MOBILITY	REPLACEMENT OF TOTAL KIDNEY FUNCTIONALITY	IMPACT ON RENAL CANCER	STAGE OF TESTING OF THE TECHNOLOGY
Automated Wearable Artificial Kidney	✓	✓	☒	☒	Clinical Trials
Wearable Artificial Kidney	✓	✓	☒	☒	Clinical Trials
Implantable Bioartificial Kidney	✓	✓	✓	Potential to reduce risk	Pre-clinical testing
Kidney Regeneration Technology	✓	✓	✓	Potential to reduce risk	Pre-clinical testing

Table 1 Comparing technological features and impact on kidney cancer risk of each recent innovation in renal replacement technology.

COMPETING INTERESTS

The authors have no competing interests to declare.

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