

Recent Advances in Renal Transplant Surgery: Pushing the Envelope

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New advances discussed will include robotic kidney transplant, management of aortoiliac atherosclerosis in the recipient, orthotopic kidney transplant, bioartificial kidney and xenotransplant

Open kidney implantation for the recipient is associated with 20% incidence of wound complications especially in obese patients. Analysis from the UNOS database has shown that 25% transplant centres do not list morbid obese patients on their wait list. It is in this setting of obese recipients, that transplant surgeons are exploring the use of robotic assisted kidney transplant (RAKT). It is performed selectively by centres of excellence in the US, Europe and India. There is a prospective multicentre European database of > 300 cases and the European centres are already offering advanced training courses for the RAKT procedure

Risk factors for aortoiliac atherosclerosis are long waiting time on dialysis, increasing age of recipients and diabetics recipients. Peripheral vascular disease increases transplant morbidity and mortality, with overall decreased patient and graft survival. Collaboration with the vascular team is essential in deciding the type of revascularization procedure required and the timing of the procedure in relation to the transplantation surgery i.e. can it be done simultaneously at the time of the transplant or does it need to be staged. Staged surgery is required for symptomatic patients with claudication, rest pain or trophic ulcers and for aortic aneurysms. Disadvantages of staged surgery is that it delays the transplant and makes the subsequent transplant more difficult because of the fibrosis from the previous operation. Simultaneous surgery is usually reserved for asymptomatic patients with moderate atherosclerotic disease. Use of a vascular graft carries long term risk of infection, thrombosis and need for long term anticoagulation. Because of all these risks, an alternative option in patients with extensive distal atherosclerotic disease or IVC thrombosis is an orthotopic kidney transplant. The native kidney is first removed and the donor kidney is then transplanted in the same position in a single operation. The donor vein is anastomosed to the native renal vein. The donor artery is usually anastomosed to the splenic artery or if that is not available, we can use the native renal artery, aorta or inferior mesenteric artery. It is a technically more challenging operation but the advantage is that it bypasses the distal atherosclerotic vessels and avoids the use of a graft.

The Kidney project is a US research project to create an implantable bioartificial kidney (iBAK). The device has 2 components, a haemofilter and a bioreactor. The haemofilter is biocompatible silicone membrane which mimics the hemofiltration physiology of the glomerulus and is mechanically driven by the patient's own blood flow. The bioreactor contains bioengineered renal tubular epithelial cells which would provide the tubular function for the iBAK. The device is designed to be implanted into the iliac fossa just like a donor kidney. A major concern will be the durability and clotting of the blood filter and frequent surgery to manipulate or change the device. Also, there is no feedback mech, meaning to say the device removes an obligate amount of fluid whether it is appropriate or not and so patients have to drink a lot of water and have their fluids and electrolytes monitored by their nephrologists. A potential benefit of this novel cell-based hybrid model is that the renal tubular cells would provide intrinsic metabolic and endocrine activity leading to freedom from anaemia and improved blood pressure control and bone mineral metabolism. A bioartificial kidney could be a bridge therapy to transplant. Only animal trials have been conducted

In 2021 NYU Langone transplant institute performed the first porcine kidney xenotransplant into a deceased donor whose organs were not suitable for deceased donation. The kidney from a genetically modified pig was successfully transplanted into the thigh of the deceased donor for 3 days. In 2022 the University of Alabama using the same deceased donor model reported a phase 1 clinical trial with a 10 gene edited pig. In their trial they removed the native kidneys of the donor before transplanting the two pig kidneys one into each iliac fossa. These early results show proof of concept but human trials will still be an ethical challenge.