

## Development of kidney transplantation as a healthcare development model to achieve Indonesia Emas 2045

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Kidney failure is a medical condition where the kidneys lose their ability to perform vital functions such as filtering blood, removing waste, and regulating the body's electrolyte and fluid balance. Kidney failure can occur suddenly (acute) or develop gradually over some time (chronic).<sup>1</sup>

The frequency of declining kidney function is on the rise due to changes in human behavior and lifestyle, as well as the lack of a widespread and structured non-communicable disease prevention program implemented by the government in the general population through health promotion and prevention programs. Various diseases resulting from these changes contribute to the decline in kidney function.<sup>2,3</sup>

Based on data from the Ministry of Health of the Republic of Indonesia in 2020, by comparing the number of kidney failure cases in the national health insurance program (JKN) to the total population of Indonesia, approximately 1,602,059 individuals had kidney failure out of a population of 271,066,366, resulting in a prevalence rate of 0.59%. According to the basic health research (*Riskesmas*) findings, the prevalence of chronic kidney disease (CKD) cases increased from 21,000 individuals in 2013 to 381,000 individuals in 2018, and it further increased to 591,000 individuals in 2020. Expenditure on CKD remains in the fourth position, amounting to 2.1 trillion Indonesian Rupiah (11.48% of the total burden of the social security agency on health [BPJS]).<sup>4</sup>

Early diagnosis, changes in behavior and lifestyle, and prompt treatment are crucial to slowing down the progression of kidney failure. Unfortunately, if end-stage kidney failure (stage 5) has already occurred, there is no other option than to undergo kidney replacement therapy. Renal replacement therapy could

be in the form of hemodialysis, peritoneal dialysis, or kidney transplant.

### History of kidney transplantation

The historical journey of kidney transplantation dates back to March 13, 1902, when Erich Ullmann conducted the first recorded clinical kidney transplantation, as documented in the 'Wiener klinische Wochenschrift.' The true milestone came in 1933 when Yuri Voronoy in Ukraine achieved the first successful human-to-human renal transplant. However, it was not until December 23, 1954, when Dr. John Murray, who later received the Nobel Prize in Medicine, performed the groundbreaking first successful kidney transplant at Brigham and Women's Hospital in Boston, saving a 23-year-old patient with end-stage renal disease.<sup>5</sup>

In Indonesia, the inaugural kidney transplantation took place on November 11, 1977, at Cipto Mangunkusumo Hospital under the supervision of a Japanese urologist from Tokyo Women Medical College. Indonesia's path in kidney transplantation has not always been smooth, with challenges including economic downturns such as the Rupiah decline in 1983, the 1998 economic crisis, and a surge in illegal organ trafficking in the early 2000s. These issues prompted the Indonesian government to enact new laws and regulations, creating a clear organ transplantation guideline.<sup>5</sup>

The landscape began to change in 2011 with the introduction of laparoscopic living donor nephrectomy (LLDN) in Indonesia, leading to increased kidney transplant procedures. Government insurance through BPJS is pivotal in making transplantation accessible to lower-income individuals. With the official establishment of Cipto Mangunkusumo Kanigara Hospital, kidney

transplant patients covered by BPJS insurance now have access to two new dedicated operating rooms for urological surgeries. This development has increased transplantation frequency from four to six–eight times per week, thereby reducing the waiting queue from a year to 8 months.<sup>5</sup>

### **Advancement in kidney transplantation**

In the realm of kidney transplantation in Indonesia, a significant turning point came in October 2011 with the introduction of the pioneering LLDN technique. This groundbreaking approach revolutionized the process, substantially reducing postoperative recovery time and donor discomfort. Families and potential donors found renewed confidence in this innovative method, especially compared to the traditional open surgical procedures often subjecting donors to 2–3 months of pain. With LLDN, donors could return to normal activities within just 1 week.<sup>5</sup>

A novel technique known as retroperitoneal kidney laparoscopy emerged as a viable alternative, focusing on minimizing donor complications. Fast forward to 2020, retroperitoneal laparoscopic donor nephrectomy has become the gold standard at Cipto Mangunkusumo Hospital, largely due to the influence of the coronavirus disease 2019 (COVID-19) pandemic. This strategic shift in surgical practice was prompted by the discovery that the virus resides in the gastrointestinal tract.

On the recipient's side, the kidney transplantation technique has remained relatively unchanged since 1954. The standard practice involves connecting the renal vein of the donor's kidney to the recipient's external iliac vein end-to-side, a technique consistently followed across various centers. However, the approach to connecting the renal artery initially mirrored the venous anastomosis. A significant transformation occurred in May 2013 with the first pediatric kidney transplantation in Indonesia, marking the beginning of changes in arterial anastomosis techniques.<sup>5</sup>

The end-to-side anastomosis technique is employed when a notable difference occurs in blood vessel diameters. This method relies on basic equipment readily available in all Indonesian operating rooms, including a 14G venous cannula and a 3.5 Fr nasogastric tube. It was further perfected through microsurgical techniques by the Department of Urology, Cipto Mangunkusumo Hospital.<sup>6</sup>

### **Multidisciplinary team**

Successful kidney transplantation relies on the team's commitment to professional growth. Aside from nurses and urologists, Indonesian anesthesiologists are sent abroad to further hone anesthesiology in transplantation. Advanced anesthesia equipment and monitoring systems enable precise anesthesia depth, circulation, fluid levels, and tissue oxygenation measurements. This progress allows rapid kidney functionality, often with urine output minutes after vascular anastomosis. Radiological imaging also plays a vital role in evaluating potential living kidney donors. Computed tomography (CT) scans with contrast are a commonly used imaging technique for assessing the kidneys before surgery and are considered the standard of excellence. Contrast-enhanced CT scans provide detailed images of focal and diffuse kidney parenchymal diseases. Furthermore, they offer information about the anatomy and anomalies in the urinary tract and blood vessels of the kidneys.<sup>7–9</sup>

### **Government role in kidney transplantation**

The involvement of the Ministry of Health of the Republic of Indonesia in increasing the number of centers performing transplants began on June 7–8, 2013, with the first-ever “The 1st National Symposium and Workshop on Kidney Transplantation,” in collaboration with the Department of Urology, Faculty of Medicine, Cipto Mangunkusumo Hospital. Government hospitals entered into bilateral memoranda of understanding with Cipto Mangunkusumo Hospital as the supporting hospital, signed by both hospital directors and the Director-General of Medical Services.<sup>5,10</sup>

From 2014 to 2019, the Cipto Mangunkusumo Hospital kidney transplantation team supported kidney transplantation programs at seven hospitals. In the first phase, all supported hospital teams visited Cipto Mangunkusumo Hospital to learn about the kidney transplantation process and administration. If the hospital met the minimum service standards, the Cipto Mangunkusumo Hospital transplantation team would visit the hospital. Afterward, they supported the kidney transplantation procedures at the local hospital. The success of this program depended on the commitment and dedication of the transplantation team and all stakeholders at the supported hospitals, resulting in varying levels of implementation, with some hospitals completing it once and others four or five times.<sup>5,6,10</sup>

The journey of creating regulations to protect kidney transplantation in Indonesia began in 2005 with various drafts such as government regulations (PP). By 2016, the Regulation of the Minister of Health of the Republic of Indonesia (PERMENKES-RI) Number 38 was issued, which became the foundation for organ transplantation services in Indonesia. This regulation led to the formation of the national transplantation committee, providing legal protection and certainty for donors, recipients, transplant hospitals, and healthcare providers involved in organ transplantation.<sup>10,11</sup>

PERMENKES-RI Number 38 Year 2016 also includes the overall organ transplantation service flow. However, the kidney transplantation service flow must be adapted to the working rules and cultures of each transplantation center to ensure the sustainability of kidney transplantation services. The legal framework for organ and tissue transplantation has been strengthened with the issuance of Government Regulation Number 53 in 2021.<sup>10,11</sup>

As of now, kidney failure patients who have been indicated for kidney transplantation must seek their own donors. Subsequently, the patient and donor will meet with a kidney transplantation coordinator to undergo the advocacy process. The advocacy team includes medical-legal, ethical-legal, legal, psychiatric, and layperson members. The decision of the full board meeting of the advocacy team determines whether someone is eligible to be a donor. Following this, the donor and recipient pair undergo more detailed examinations to prepare for transplantation, including laboratory matching, radiology imaging, and operational tolerance assessments from various other disciplines based on the patient's comorbidities.<sup>10</sup>

### **Kidney transplant during the pandemic era**

During the COVID-19 pandemic in Indonesia, the last transplantation at Cipto Mangunkusumo Hospital was performed in the second week of March 2020. In an online meeting on April 8, 2020, involving countries conducting kidney transplantation and those affected by COVID-19, protocols were discussed for initiating transplantation in the COVID-19 pandemic era. Although these protocols were not fully established and recognized worldwide, they could be implemented when all requirements were met. Implementing these protocols was challenging at Cipto Mangunkusumo Hospital, where COVID-19 patients were also being treated and managed, as it required categorizing areas

into red, yellow, and green zones according to the risk of COVID-19 transmission. The Cipto Mangunkusumo Hospital team, which also performed transplantation at a private hospital meeting the criteria of a green hospital in the COVID-19 era and complying with kidney transplantation protocols during this time, managed to conduct the procedure in early May 2020.

### **Collective reflection in the field of kidney transplantation**

The lesson of kidney transplantation development in Indonesia is a miniature depiction of how various components of the healthcare profession or those related to the healthcare world interact to achieve a common vision that addresses the needs of patients and the national healthcare requirements. However, vision alone is not enough; concrete steps require collective sacrifices. This is evident in the early phases of transplantation development. To progress, it is necessary to consider the well-being of all involved components. Continuous innovation is required even after success is achieved. Lastly, the lessons from the development of kidney transplantation in Indonesia should serve as a lesson for all nations in providing healthcare.

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