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Correlation between Amount of Artery and Estimated Glomerular Fitriation Rate(eGFR) with Operative Time of Mini Open Donor Nephrectomy (MODN) in Renal Transplant: A Single Centre Report

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ABSTRACT— The end-stage renal disease (ESRD) in Indonesia continues to increase. This causes an increase in the need for kidney transplants. Prior to 1994, open donor nephrectomy (ODN) was considered as a standard procedure for kidney donors. Open donor nephrectomy is a safe operation but this technique is associated with significant morbidity in terms of disability, cosmetics, leg injuries, incisional hernias, neuralgia, and lower back recovery. Higher procedure costs are also a major problem. Mini-incision donor nephrectomy (MODN) has now been developed as an option for donor nephrectomy. MODN has advantages including less postoperative pain, early recovery and fewer complications and later incisional hernias. The purpose of this study was to examine the number of arteries & estimated Glomerular Filtration Rate (eGFR) with the MODN surgery time. This is an observational, cross sectional study. Data collected from the medical records of patients who were transferred kidney transplants from January 2014 to December 2018 at the Kariadi General Hospital Semarang, Indonesia. There are 20 patients, 15 males and 5 females. Total donor relationships with related recipients were 15 patients, 5 were unrelated. The average ischemic time was 38.65 ± 1.81 minutes (range 36-42). Total patients do not need a blood transfusion after a kidney transplant. The average operating time is 58 ± 95 minutes (range 55-63). The average number of Arteries involved was 2.55 ± 0.69 (range 1-4), the average value of eGFR donors after surgery was 87.84 ± 1.36 (range 84.51 - 89.44). Data were analyzed by the Spearman test in SPSS version 23. This study showed that the operating time was significantly correlated with the number of arteries & eGFR ($p < 0.001$). In conclusion, the operating time has a significant amount with the number of arteries & eGFR. The faster the time required for surgery, the higher the eGFR after surgery should have better results, and the fewer arteries involved during surgery will heal faster and will not cause complications.

KEYWORDS: *Operative Time, Renal Transplantation, Mini Open Donor Nephrectomy, Open Donor Nephrectomy, Amount of artery & eGFR*

1. INTRODUCTION

The end-stage renal disease (ESRD) in Indonesia continues to increase. [1,2] This causes an increase in the need for renal transplants. [3] Based on the data from the 8th Indonesian Renal Registration: 21,050 new

cases of renal dysfunction, 89% were ESRD. [4] The fundamental problems that have occurred in recent years in Indonesia regarding renal transplants are government policies, human resources, funding, cultural & religious views. [5] Nevertheless, renal transplants in Indonesia have continued to run and have improved since 2011, marked by the establishment of the National Transplant Committee and the national health insurance for kidney transplants. [6] We reported 34 transplants in Kariadi General Hospital Semarang, Indonesia from January 2016 until December 2019, the number has risen significantly within the past 5 years. [7] There were four transplants in 2016, seven in 2017, nine in 2018 and fourteen in 2019. [8]

Prior to 1994, open donor nephrectomy (ODN) through a classic lumbotomy incision was considered as a standard procedure for renal donors. Open donor nephrectomy is a safe operation. This technique can produce good organ transplants but this technique is associated with significant morbidity in terms of disability, cosmetics, leg injuries, incisional hernias, neuralgia and low back pain. Higher procedure costs are also a major problem. [9] Mini-incision donor nephrectomy has now evolved as an option for donor nephrectomy. Twenty consecutive donors, including nephrectomy completed using a small incision in the rib cage, were evaluated. MODN have advantages including less postoperative pain, early recovery and less possible injury complications and later incisional hernias. [10] The length of time of surgery, length of stay in hospital, number of arteries and eGFR evaluated.

2. Materials and Methods

This was an observational, cross sectional study. Data collected from the medical records of patients who were transferred renal transplants from January 2016 to December 2019 in Kariadi General Hospital Semarang, Indonesia. We evaluated 20 data patient MODN and the extracted data was included age, gender, body weight, body mass index (BMI), incompatibility of human leukocyte antigen (HLA), relation to the donor, length of stay, surgery date, comorbid factors (diabetes mellitus, depression, hypertension, heart disease, stroke, tuberculosis chronic gastritis and others), left Ventricle ejection fraction (LVEF), blood laboratory (leukocytes, hemoglobin, platelets, creatinine, urea, Na, K, Cl), culture (drainage fluid blood, urine), ischemic time, and the number of arteries and veins in the donor. eGFR is estimated according to the Cockcroft Gault formula. Amount of artery are the number of arteries in the right kidney and the stem involved in the surgical procedure. Operative time was defined as time elapsed from skin incision to placement of the final skin suture. [14]

2.1. Inclusion criteria

The subjects of this study were all patients who needed a renal transplant using the MODN technique that required medical records from January 2014 to December 2018 in Kariadi General Hospital Semarang, Indonesia

2.2. Exclusion Criteria

Exclusions criteria were the patients who canceled renal transplants; patients with previous renal or adrenal surgery, and ipsilateral retroperitoneal surgery were previously contraindicated for MODN.

2.3 Technique

The patient went through general anesthesia and positioned in right lateral decubitus. The table flexed at the level of iliac crest and the remaining of kidney elevated. The left arm was rested over the hand rest. An oblique incision, 6-8 cm long, made from the end of the 11th rib to the lateral border of the rectus abdominis muscle. The skin, subcutaneous tissue, layer of muscle, and lumbar fascia are sliced. The peritoneum is reflected with blunt dissection and a retroperitoneal space is mounted that reflects the peritoneum medially.

The fascia is added from the lateral side and the kidney is dissected from the lateral and posterior sides. The upper pole is then removed from the adrenal allocation. The dissection is then taken caudad with special care to be removed in the gonad vein. The ureter switches medial to the gonad vein and is dissected until the iliac artery bifurcation. Renal vessels are carefully dissected to their origin and returned from lymphatic tissue. Lasix and mannitol are given to donors. When the receiving team is ready, the ureter is divided after cutting the tip with a Hem-o-lok clip. The renal arteries are then double ligated near their origin. The renal veins are then distally clamped to the origin of the adrenal and gonad veins with vascular clamps, and divided proximal to them. Renal are taken from the field and placed on ice. The renal vein stump is then sutured with continuous prolene sutures. Hemostasis is achieved and closure of the abdominal wall done. For the record, we do not use a permanent retractor system for this procedure; The retractor is held by an assistant instead. [9,11]

2.4 Statistical analysis

Data was analyzed with Saphiro wilk in distribution normality or not, then variables were analyzed using the spearman's test. Analysis was done using the statistic software. P values < 0.05 were taken as statistically significant.

3. Result

A total of 20 MODN living donors were involved in a study involving nephrectomy donors from January 2016 to December 2019. All patients met the inclusion criteria and were recruited in the study after obtaining the necessary informed consent and information. Descriptive data has explained in (Table 1). Data collected from the medical records of patients obtained by renal transplants from January 2016 to December 2019 at Kariadi General Hospital Semarang, Indonesia were 20 patients. The total respondents were 20 patients, 15 males and 5 females. The mean age was 35.90 ± 11.32 years (range 15-50). The number of donor-related relationships with recipients was 15 patients, 5 unrelated. The average ischemic time was 38.65 ± 1.81 minutes (range 36-42). The number of patients has no interference after a renal transplant. Total patients had no transfusion after renal transplantation. The average operating time was 58 ± 95 minutes (range 55-63). The average number of Arteries involved was 2.55 ± 0.69 (range 1 - 4), the average value of eGFR donors after surgery was 87.84 ± 1.36 (range 84.51 - 89.44). Previous studies explained that there were no significant differences between donor age, sex, body weight, right / left renal in MODN and ODN. did not reach statistically significant statistics. P value> 0.05.

Table 1. Descriptive data

Variable	F	%	Mean ± SD	Median (min – max)
Age			35,90 ± 11,32	39,5 (15 – 50)
Sex				
male	15	75,0		
female	5	25,0		
Related				
related	15	75,0		
nor related	5	25,0		
Ischemic time			38,65 ± 1,81	38,5 (36 – 42)
Transfussion				
(+)	0	0		
(-)	20	100		
Artery			2,55 ± 0,69	3 (1 – 4)
eGFR			87,84 ± 1,36	87,91 (84,51 – 89,44)

Operative time	58,95 ± 2,54	59 (55 – 63)

All procedures were carried out according to plan without conversion. In the MODN group, the operating time (skin to skin) was significantly fast. The estimated number of arteries needed is less and posting eGFR operations is still good. eGFR is estimated according to the Cockcroft Gauld formula. No need for re-exploration in one of the groups. Get a significant difference with operating statistics the faster, the fewer arteries needed (p 0,010) and the higher the postoperative eGFR value (p 0,003). (Table 2)

Table 2. Correlation spearman's test between operative time and amount of artery and eGFR

Variable	Operative time		Result
	p	r	
Artery	0,010	0,562	Significant, positive, middle
eGFR	0,003	0,623	Significant, positive, strong

4. Discussion

4.1 MODN compared to ODN

In this study, average operating time of 58.95 ± 2.54 minutes (55-63) has an average length of stay of 3.45 ± 0.51 days (3-4). Other studies show an average MODN operating time of 53.9 minutes has an average length of stay of 2.44 days [9] and an average operation of 171 minutes has an average length of stay of 6.5 days. [13] In the study looking for an average operating time, ODN was 180.5 ± 26.2 minutes [14] and other studies open nephrectomy surgery time was 246.3 ± 24.4 minutes. [15] Operating time significantly shortened by 55 minutes when compared to open donor nephrectomy, this has economic implications with less pain left and greater productive. Besides that, a small short MODN gives better cosmetic results than a short ODN or some incision. [10] Likewise, the recovery time of MODN was shorter when compared to ODN. The advantages from MODN are the short operation time, less arteries used, good amount of eGFR after surgery, and a cosmetically better result, and a positive increase in potential surviving donors. [10] This study provides an analysis of the published literature comparing Mini Open Donor Nephrectomy (MODN) with Open Donor Nephrectomy (ODN). Mini-donor nephrectomy has many advantages. The procedure is safe, does not require expensive equipment or special training, and instructions for leaving earlier from the hospital. problem of pneumoperitoneum was eliminated. The average incision is about 6 cm to 8 cm. The average time of warm ischemia was more than 2 minutes (range: 1 to 4 minutes). The average harvest time was 46 minutes. Ribs were not removed, thus avoiding related problems. [8] MODN set as a procedure using an incision with length <15 cm (Table 1) anterior to eleven or twelfth ribs without rib resection and using retroperitoneal. ODN determination as retroperitoneal the procedure is done through a long side incision with patient in lateral decubitus position. Rib Resection was done in some cases as needed. [10]

When compared with ODN, hospitalization and time to return to work are significantly shorter but without surgery or warm ischemia time. Also, incidents of hernia incisions and prominent injuries appear to be lacking in MODN. MODN can also reduce complications. MODN can provide a more cost-effective alternative for developing countries where laparoscopic equipment may not be affordable or unavailable [16] Likewise, time spent faster to be returned for MODN work is available with ODN using more economic implications more leave and greater productivity. MODN also provides cosmetic results that are better than long incisions or ODN. [10]

Donors who request MODN request fewer postoperative analgesia and shorter hospitalizations from the

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ODN group. [10] Findings related to MODN and ODN were discussed by Yang et al. [17], which means differences about the shorter duration of narcotics use in the MODN group. Apart from MODN and ODN surgery, there is also LDN (laparoscopy donor nephrectomy) surgery. LDN leads to higher urological complications in recipient transplants. The ureter is very susceptible to ischemic injury, as the only blood supply of ureteral branches from the renal arteries, which can be easily used during donor operations. This may be the main problem in the laparoscopic procedure. Some studies show LDN leading to a higher decrease in serum creatinine received by recipients in ODN transplants. This has to do with longer ischemia-warm times and secondary urinary donation due to prolonged pneumoperitoneum. MODN provides significant benefits to donors when compared to ODN. [18] This study provides an effort to analyze MODN by implementing ODN literature. MODN seems to combine the benefits of ODN and LDN. Also, incidents of hernia incisions and prominent injuries are less visible in MODN group. There may also be a decrease in the level of complexity and the amount of postoperative analgesia needed in the MODN group. Sensitivity analysis. Eliminating long-term complications. MODN can reduce complications. When compared to the ODN, MODN provides a shorter adjusted operating time.

Correlation between amounts of artery with operative time

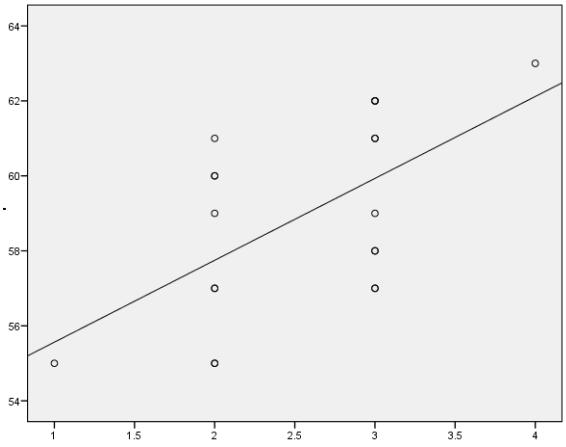

Figure 1. This chart shows the correlation amount of artery with operative time

In our analysis with the Spearman test, there was a significant result between the operating time and the number of arteries. The average operating time of 58.95 ± 2.54 minutes (55-63) has an average length of stay of 3.45 ± 0.51 days (3-4). The average number of Arteries involved was 2.55 ± 0.69 (range 1 - 4). From this study the results obtained the faster time needed for surgery, the fewer arteries involved (p = 0,010). The faster the operation, the fewer arteries involved so that less blood loss occurs intraoperative. So it will certainly speed up recovery time and reduce the length of stay. Diuretics, which are not fragmented (whenever there are no contraindications) are given just before occlusion of the renal arteries. [19] Initially, the arteries were secured using a polymer clip locking, but due to instances where the clip was not safely inserted. Arteries that cause bleeding, decisions are made next to the arteries and renal veins are secured by linear staplers. Several methods were chosen to control the renal artery. Most used plastic clips are self-transposed ligation before the transect, with the main one. The reason of using this was to obtain the better arterial length. Unfortunately, due to secondary bleeding episodes from falling clips, it has to change to a different technique by using vascular staplers to bind to the arteries and veins of the renal, and check the stapler's lines before vessel transection. [20] Another problem is the use of the right or left renal donor. In particular, there is a preference for the left side, given attention to vascular control and blood vessel length. [21]

Based on previous research, 11.1% of donors had multiple renal arteries, in contrast to 17% in the UCSF series and 23% in the Northwestern series. Every effort was made to support all branches, so as to help each branch available or not. polar branch. There was a significant increase in the 2008 group with multiple renal arteries. Three cases resulted from the application of vascular stapler with early bifurcation and it was found to be large if bifurcation <1 cm from the aorta. conversion. Overall, 17.8% of renal donors need to be treated with anastomosis. Renal that need blood, construction that requires allograft related, both short and long term, with the same without accountability. [15]

Correlation between eGFR with operative time

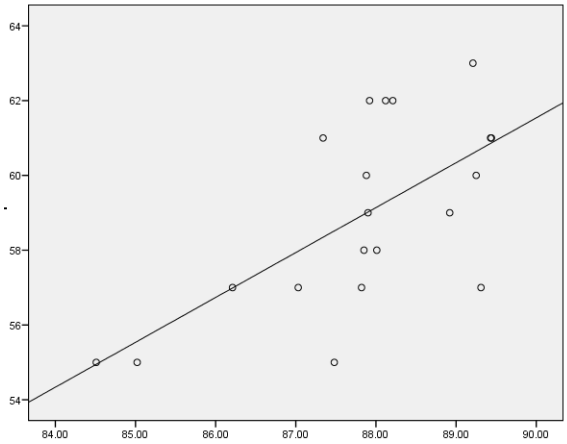

Figure 2. This chart shows the correlation eGFR with operative time

1 - 89.44). From this study the results obtained the faster time needed for surgery, the higher the value of postoperative eGFR (p=0,003).

Donor nephrectomy suddenly about 50% of nephron mass with a direct and associated decrease in eGFR; However, contralateral healthy renal parenchyma still has the ability to recover an insignificant percentage in a relatively short time - as early as one month 22 Velosa et al. demonstrated this as early as possible. A few weeks after nephrectomy, kidney function has recovered which is slightly higher than that reached six months later with amectectomy. [23] In long-term follow-up, more elderly donors had eGFR <60 mL / min (131 (80%) compared to 94 (31%), *P* <0.001). [24,25] A study by Poggio et al. [26] of 1,015 donors approved a eGFR of around 4 mL / min per 1.73 m2 per lifetime for donors younger than 45 years, compared to 8 mL / min per 1.73 m2 per 45 years older. Some researchers hypothesize that older kidney donors will increase capacity "which will manifest as kidney function after donation". [27]

Based on previous research it was found that older donors had lower eGFR before contributing, but there was no difference in the mean. The average in eGFR is 38% ± 9%. Within 5 years after donation, larger donors had a eGFR <60 mL / min compared to younger donors 131 [80%] vs 94 [31%], p <0.001). Kidney function was stable during the follow-up period and there were no donors with a eGFR of less than 30 mL / min during the follow-up period. The renal consequences of reducing acute nephron mass, such as after nephrectomy, were studied in the late 19th century. [28] Thirty years ago, Barry Brenner developed an elegant theory of the pathophysiological solution of increasing nephron mass. [29-30] After nephrectomy, the kidney can receive functional adaptation with increased filtration in every single nephron due to an increase in plasma flow, which increases with an increase in intraglomerular pressure. [31-32] In a 10-year

follow-up study, Garg et al. shows that 40% of donors estimate a eGFR of between 60 and 80 mL / min, 12% between 30 and 59 mL / min and 0.2% <30 mL / min. [33]

Some authors have more important factors that can reduce the value of eGFR. The most cited factor associated with the risk of decreased eGFR is doubtless the age, which is not fully surprising. Interestingly, a high body mass index (BMI) also has a lower risk of post-donated EGFR in the studio of Ibrahim et al. [34] which is perhaps one of the best studies from a methodological point of view. In recent work limited to donors with health insurance in the US, supporting the risk of CKD Stage 3 (eGFR <60 mL / min) that affects doubling in African-Americans and donor Caucasian donors. [35]

4.2 Characteristic of variables in Mini Operation Donor Nephrectomy

Variable Variables in Mini Donor Nephrectomy Operation The sex in the open mini donor nephrectomy in this study had a total of 15 males and 5 female respondents. In a studio where the average age of the donor was 35.90 ± 11.32 years. Increasing age of the donor kidney also has greater functionality, therefore an intense initial inflammatory response can repair damage to this kidneys.18 In other studies the average kidney transplant was 42.3 ± 11.8 years 13 and 44 years. [11] This is consistent with our findings, which show an average age below 60 years which means geriatric, increasing age related complications in surgery increases. Total patients were no transfusion after renal transplantation with MODN. Another variable is ischemic time. In this study, the total ischemic time was 38.65 ± 1.81 minutes. In other studies, with open donor nephrectomy, it takes about 85.95 ± 23.511. This shows the time in MODN is shorter than ODN. The amount of time is determined as the time of disturbance of the renal artery or aortic clamp, until the time of release in the recipient's renal artery (in hours). Total ischemic time is a combination of cold ischemic time (CIT) and warm ischemic time (WIT). [36] Many studies have proven that CIT is a factor that influences independent of delayed graft function (DGF), a longer time in hospital because there is an increase in maintenance costs. [37]

5. Conclusion

In this study, we found a significant difference between operating time and the amount involved and the value of eGFR after surgery. The faster the time required for surgery, the higher the eGFR after surgery should have better results, and the fewer arteries involved during surgery will heal faster and will not cause complications. All MODN patients in this study did not require blood transfusion. Ischemic time in MODN is shorter than ODN. In addition, MODN provides better and better results than open donor nephrectomy.

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