Original Article

En Bloc Kidney Transplantation from Pediatric Donor to Adult: A Single Center in Thailand

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Objective: En Bloc Kidney Transplants (EBKT) from pediatric donor have been performed at Ramathibodi Hospital, Thailand since January 2014. We review and report our clinical outcome.

Materials and Methods: Retrospective data records between January 2014 to December 2016, 3 cases of EBKT were performed in our hospital. The technique and outcome of EBKT were reviewed. The literature was also reviewed regarding to clinical outcome and indication for EBK.

Results: 3 EBKTs were performed between 2014 to 2016. The 1 year graft survival rate was 100%. No surgical complication, delayed graft function, acute rejection episodes were found. There was neither morbidity nor mortality.

Conclusion: En Bloc Kidney transplants (EBKT) in our center were safe and with excellent outcome when optimize selected criteria were optimized. EBK could improve the rate of kidney transplants in developing countries.

Keywords: En Bloc Kidney Transplant, Pediatric donor, Outcome

J Med Assoc Thai 2019;102(Suppl.2): S9-12
Website: http://www.jmatonline.com

Disparity between kidney donor and waiting list recipient is the major problem around the world. The best treatment of end stage renal failure (ESRD) is kidney transplantation. Several strategies were employed to reduce disparity such as, Expanded criteria donor (ECD), Dual Kidney Transplant (DKT), En bloc Kidney Transplant (EBKT) from pediatric to adult recipient. In 1987, a successful EBKT from an encephalic newborn to an adult was reported in Thailand(1). Our institute began EBKT in 2014.

There was still no definite criteria for use of single kidney or double kidneys from pediatric donor for kidney transplantation. The North American Pediatric Renal Transplant Cooperative study has shown data that pediatric kidney donor was associated with increase rate of graft loss due to vascular thrombosis(2). We, therefore, review our clinical experience regarding update criteria use in single versus double kidney and surgical techniques for EBKT.

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Materials and Methods

This study was approved by human research ethic committee of Ramathibodi Hospital, Mahidol University.

From January 2014 to December 2016, 3 cases EBKT were performed in our hospital. The medical records were reviewed including surgical techniques, perioperative variables, surgical complication, patient and graft outcomes. Demographic data were collected on the donor (age, sex, initial and terminal serum creatinine, cause of death) and recipient (age, sex, cause of ESRD, history of diabetes mellitus and hypertension, panel reactive antibody, cold ischemic time, blood loss, relative warm ischemic time, human leukocyte antigen (HLA), acute rejection, surgical complication, operative time and delay graft function).

Statistical analysis

Statistical analysis used Descriptive statistics in study due to small number of patients. Analyses were carried out using the STATA program version 14.

Definition

En bloc kidney transplant was defined as transplant of both kidneys into a single adult recipient and using the donor aorta and vena cava for vascular anastomosis(3).

Cold ischemic time (CIT) was defined as the time

How to cite this article: Arpornsujaritkun N, Pootracool P, Jirasiritham S, Tirapanich W, Gesprasert G, Sakulchairungrueng B, Kantachuvesiri S, Viseshsindh W, Leelaudomlipi S, Sriphojanart S. En Bloc Kidney Transplantation from Pediatric Donor to Adult: A Single Center in Thailand. J Med Assoc Thai 2019;102;Suppl.2: S9-12.

that an organ surgically removed for transplantation remains in chilled in perfusion solution before engraftment.

Anastomosis time (AT) was defined as the time between the end of the cooling period to successful renal artery anastomosis and perfusion of the donor kidney[4,5].

Delayed graft function (DGF) was defined as the need for dialysis within the first week post transplantation.

Criteria for En Bloc Kidney Transplant (EBKT)

In our center, we consider EBKT if the donor meets one of the list below

1) Donor age less than 5 years old.

2) Donor body weight less than or equal 18 kilograms.

3) Kidney size less than 8 centimeters.

Operative technique

Both kidneys of donor were procured with aorta and inferior vena cava (IVC) that connect to renal arteries and veins. Back bench of en bloc kidney were prepared by removing perinephric fat outside renal hilum, over sewing at suprarenal aorta and vena cava by Prolene No. 6/0, meticulous ligation lumbar and mesenteric branch (Figure 1).

EBKT were transplanted using classic Gibson incision. We usually use right side extra peritoneal iliac fossa. En bloc kidney(EBK) was replaced extra peritoneal and end to side anastomosis fashion between the donor infrarenal aorta and the external iliac artery, between the donor infrarenal IVC to the external iliac vein (Figure 2). The ureters were implanted separately with Lich-Gregoir technique. Double-J catheters (4.8-French; 14 cm) were implanted in each ureter and were withdrawn at 14 days post transplantation.

Anticoagulant was not routine use for prophylaxis graft thrombosis.

Pre-and post-transplant immunosuppression

All cases were induction with antithymoglobulin (ATG) or antiinterluekin -2 receptor antibodies (anti-IL-2) and maintenance with calcineurin inhibitor, antimetabolite and prednisolone.

Results

From January 2014 to December 2016, our center performed 3 EBKT cases from pediatric donors. Donor characteristics were shown in Table 1. Mean donor age is 2.75 years old. All donors were female. Mean body weight is 12.33 kilograms. Mean initial serum creatinine and terminal serum creatinine are 0.47 and 0.22, respectively. The cause of death from trauma 2 cases and 1 case from rupture intracerebral aneurysm.

The recipients' characteristics were shown Table 1. Mean recipient age is 44 years. 2 of 3 cases were male. All recipients have PRA less than 10%. The mean of HLA mismatch is 1.33.

The operative characteristic was shown in Table 2. Mean cold ischemic time (CIT) is 958.67 minutes. Mean anastomosis time (AT) is 32.67 minutes. Mean total operative time 293 minutes. Mean blood loss is 400 milliliters.

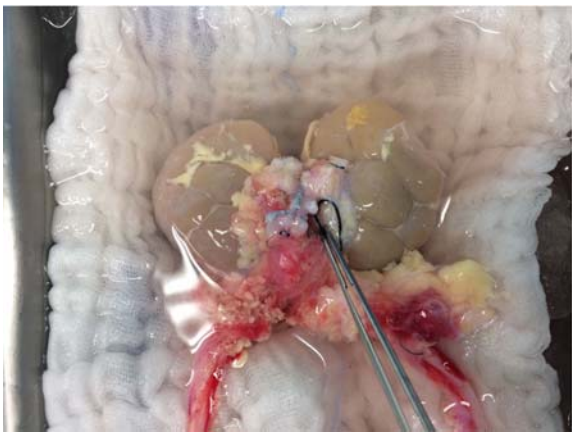

Figure 1. Bench surgery En Bloc Kidney Transplant (EBKT). Over sewing at suprarenal aorta and vena cava by Prolene No. 6/0 and meticulous ligation lumbar and mesenteric branch.

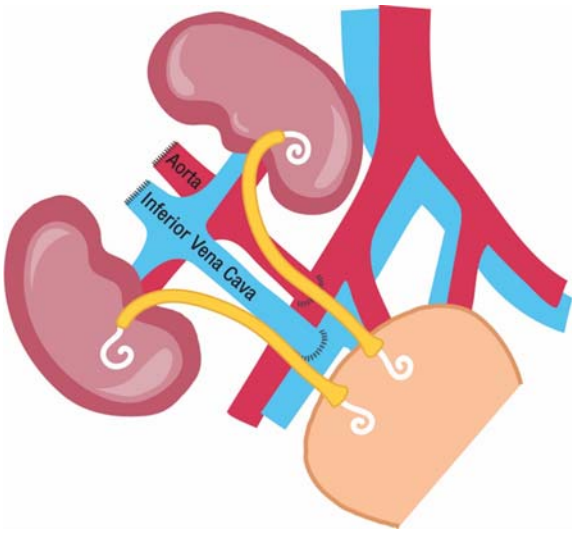

Figure 2. Surgical technique of En bloc Kidney Transplant (EBKT). Suprarenal Aorta and Vena Cava were oversewing with Prolene No. 6/0. Infrarenal Aorta and Vena Cava were separate end to side anastomosis fashion with external iliac artery and vein.

Outcome of EBKT was shown in Table 3. All cases showed no delay graft function, wound infection, acute graft rejection, primary nonfunction. Urinary tract infection was found 66.67%. Mean length of stay is 17.33 days. 1 year graft survival rate was 100 %. Maximum and minimum follow-up between 1 to 3 years. The characteristic of serum creatinine level post EBKT within 14 days was shown in Figure 3.

Table 1. Donor and recipient characteristic

Characteristic	$\bar{x}$, n
Donor	
Age, years	2.75±2.17
Sex, (%)	
Male	0 (0/3)
Female	100 (3/3)
Body weight, kg	12.33±5.67
Initial serum creatinine, (mg/dl)	0.47±0.19
Terminal serum creatinine, (mg/dl)	0.22±0.11
Cause of death, %	
Trauma	66.67 (2/3)
Non-trauma	33.33 (1/3)
Recipient	
Age, years	44±5
Sex (%)	
Male	66.67 (2/3)
Female	33.33 (1/3)
Pretransplant dialysis exposure, years	3.5±3.04
PRA >10%, (%)	0 (0/3)
No of HLA mismatch	1.33±1.15

Table 2. Operative characteristic

Characteristic	$\bar{x}$
CIT, min	958.67±261.97
AT, min	32.67±7.77
Total operative time, min	293±20.82
Blood loss, ml	400±173.21

Table 3. Outcome of en bloc kidney transplantation

Characteristic	Result
Delayed graft function	0/3 (0%)
Wound infection	0
UTI	2/3 (66.67%)
Acute rejection	0
Primary non-function	0
Men length of stay	17.33 (±1.53)

Discussion

About 50 % of kidney transplantation in Thailand derives from deceased donors. At present, our country allowed only deceased donor KT from donation after brain death (DBD) by law. Our center rarely performed en bloc kidney transplantation (EBKT) due to low rate organ donation from pediatric donor. The report from Organ sharing center at Thai Red Cross found that potential donors from age group lower than 11-year-old about 1.1% each year[6]. In addition, utilization of donors from this group is then lower than 1.1%.

This study is small so we cannot draw definite conclusion criteria to select pediatric donor for EBKT. Several studies debate between maximize utilize kidney from pediatric donor and surgical complication after EBKT. The large case series from Spain[7] report that graft loss due to surgical complications was more frequent in EBKT than in adult brain-dead donors (15% vs. 2.2% in BDD; $p<0.001$).

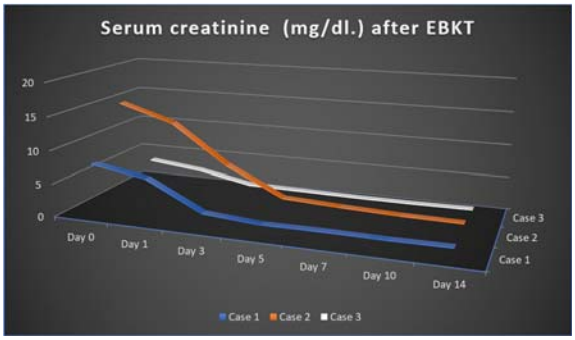

Figure 3. The characteristic of serum creatinine post EBKT within 14 days.

The pediatric donor factors for selecting single or en bloc kidney transplants are age, weight, kidney size. Most concern is weight and kidney size. Suresh Kumar et al[8] report data from the Organ Procurement and Transplant Network (OPTN) and proposes donor weight exceeding 10 kilograms was associated with acceptable graft outcomes and can be splitting of pediatric donor en bloc kidneys for transplantation into 2 adults. Some researchers proposed about kidney size. Uemura et al[9] report that single kidney size length more than 6 centimeter from pediatric donor provides adequate renal function with a speedy increase in allograft size.

EBKT is associated with higher risk graft loss from thrombosis than single kidney graft from DBD[7]. Graft thrombosis attributes to surgical technique, hypotension or hypo perfusion, small vessel size, torsion of kidney, thrombus formation in bind ends of aorta or IVC. Routine anticoagulant prophylaxis for graft thrombosis showed no benefit in EBKT[10].

The risk of urological complication is increased due to small size of ureters. Most common surgical technique of ureteroneocystostomy were separated anastomosis with bladder under stent. There was another technique with first case report by Kato et al[11] in 2008. They use "bladder patch technique" and this technique has been successfully used in recipients with a small bladder capacity. One potential concern with this technique is the inadequacy of blood supply to the donor bladder wall. In 2011, Dogan et al[12] report bladder patch technique can preserve the natural anti-reflux mechanism in childhood. In our data, we used Lich-Gregoir technique in all patients. We found no urologic complication. The stents were removed in 14 days after operation. This separately ureteroneocystostomy with Lich-Gregoir technique with a ureteric stent may be another surgical option. Several studies report outcomes of EBKT associated

with better than single kidney or living donor kidney transplant[13-16].

Conclusion

En bloc pediatric kidney transplantation (EBKT) from pediatric donor to adult recipient has good outcome. There was still no definite conclusion for EBKT offering criteria. In performing EBKT, surgeon must weigh between center experience and surgical complication. Risk and benefit of successful EBKT depends on expertise of team in each institute. In the future, EBKT guidelines should be set and applied to increase number and quality of kidney transplants in our country.

What is already known on this topic?

En bloc kidney transplant are safe and have excellent outcome when using optimized selected criteria.

What this study adds?

This study is first case series about En bloc kidney transplant in Thailand. The result is a good outcome. It can improve the rate of kidney transplants in developing countries.

Acknowledgements

The authors acknowledge Dr. Pornthep Pramyothin in reviewing manuscript and Ms. Nipapan Choonu for assistance in the study.

Potential conflicts of interest

The authors declare no conflict of interest.

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