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Research Article

Right or Left, Safety is Kept…Donor Hepatectomy is Safe

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Abstract

Introduction: Living donor liver transplantation (LDLT) help to bridge the gap between needs and demands, particularly in countries with limited cadaveric resources. Donor left lateral segmentectomy (LLS) was thought to be safer. Our aim is to evaluate the experience of King Faisal Specialized Hospital and research center (KFSH&RC), Riyadh, KSA in liver living donor surgery and to compare donor hepatectomy morbidity between LLS, left lobe (LL) and right lobe (RL) hepatectomy.

Method: Retrospective study of patients who received LDLT at KFSH and RC between 1/2011 and 12/2013 and followed up till 6/2015.

Results and Discussion: Between 1/2011 and 12/2013, a total of 305 liver transplantations were performed at KFSH&RC; of which 228 LDLT were done. The donors were mostly males 69% (n = 157), age ranged between 18 and 42 years (median 27.4 years). The overall donors' morbidity was 13.6% in the three years (2011 - 2013). Thirty-one donors had complications out of the 228 donors operated; the 31 donors had 37 morbidities. The complication rate was10.6%, (n = 7) in 2011, 22.4%, (n = 17) in 2012 and 8%, (n = 7) in 2013. Most complications were mild to moderate, 7 complications graded as Clavien I (19%), 20 as Clavien II (54%) and 10 as Clavien III (27%). Biliary complications were the most frequent morbidities making 45.9% of all morbidities, (17 out of 37 morbidities).

Right lobe (RL) grafts were 52%, (n = 118), Left lateral segments (LLS) were 41%, (n = 94) and Left lobes (LL) were 7%, (n = 16) with morbidity rates 13.6%, 12.8%, 18.8%, respectively. These results showed that right donor hepatectomy did not have a higher morbidity rate compared to left hepatectomy or left lateral segmentectomy.

Conclusion: Results and Discussion

Keywords: Donor; Hepatectomy; Safe

Introduction

Hepatic regeneration of the grafts in the recipient and the liver remnant in the donor is central to the success of live donor liver transplantation (LDLT). The graft and the liver remnant both regenerate to adequate volumes. Many factors influence this process. At the cellular level, regeneration begins immediately. The majority of the process is complete within the first two weeks, but the process of remodeling usually continues up to 1 year [1,2].

Worldwide, there is increasing need for liver transplantation, but the supply of organs is the limiting factor and a significant number of patients die in the waiting lists. LDLT has emerged as an important option for many patients; particularly small paediatric patients. The evolution of split liver transplantation is the basis upon which live donor transplantation has become possible. Donor safety is corner stone and cannot be compromised regardless of the needs for the intended recipient.

The outcomes after LDLT have been at least comparable to those of deceased donor liver transplantation (DDLT). Working in both ways, all efforts should be made to improve cadaveric organs donation so as to minimize the need for LDLT. Transplant physicians, particularly surgeons, must take responsibility for regulating and overseeing these procedures [3].

The LDLT is considerably a more complex process than whole organ cadaveric donor transplantation and there are unique considerations involved in the assessment of any specific recipient and donor. The critical issue of size matching is determined by both the actual size of the donor graft and the recipient weight as well as the degree of recipient portal hypertension. This is creating an escalating need to use bigger grafts (right lobes) in adult recipients, however, there is a general believe that RL hepatectomy is associated with more risks than removing smaller grafts. Unfortunately, most of the literatures come from countries where LDLT is not done in large volumes.

Saudi Arabia is one of the leading liver transplant countries in Middle East, where there is increasing number of patients with ESLD in the waiting lists but with limited cadaveric resources. We are presenting the experience of King Faisal Specialized Hospital and research center (KFSH&RC), the largest liver transplantation center in Saudi Arabia, in regard to liver donor surgery (Figure 1).

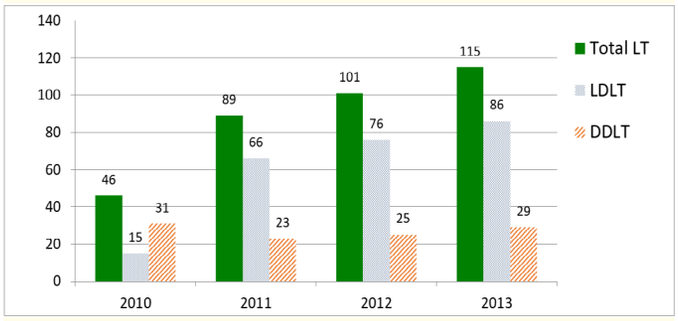

Figure 1: Liver Transplants Activities in KFSH&RC between (2010 – 2013).

Methods

This is a retrospective study of living liver donors, who underwent a donor hepatectomy at KFSH&RC liver transplantation program, Riyadh, KSA in the period between January 2011 to December 2013.

We reviewed the electronic and paper charts of all completed living donor hepatectomy; there were 228 living donors. Follow up was done till 6/2015. Variables collected were demographic (relation, age, gender, weight (WT) and body mass index (BMI)), post-operative stay, operative data (operative time, blood loss),

Grade	Definition
Grade I	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions
	Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgetics, diuretics, electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside
Grade II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications
	Blood transfusions and total parenteral nutrition are also included
Grade III	Requiring surgical, endoscopic or radiological intervention
Grade IIIa	Intervention not under general anesthesia
Grade IIIb	Intervention under general anesthesia
Grade IV	Life-threatening complication (including CNS complications)* requiring IC/ICU management
Grade IVa	Single organ dysfunction (including dialysis)
Grade IVb	Multiorgan dysfunction
Grade V	Death of a patient
Suffix "d"	If the patient suffers from a complication at the time of discharge (see examples in Table 2), the suffix "d" (for "disability") is added to the respective grade of complication. This label indicates the need for a follow-up to fully evaluate the complication.

*Brain hemorrhage, ischemic stroke, subarrachnoidal bleeding, but excluding transient ischemic attacks.
CNS, central nervous system; IC, intermediate care; ICU, intensive care unit.

Figure 2: The Clavien-Dindo Classification of Surgical Complications.
(Annals of Surgery; Volume 240, Number2, August 2004)

graft characteristics (type, weight and liver remaining volume) and donor morbidity. We detected and classified morbidity by using the multi-tier grading system developed by CLAVIEN [4], Dindo [5] (Figure 2). Analysis of data and comparison of RL, LL and LLS morbidity was done using descriptive statistical methods. The data were arranged in respective groups by using Microsoft Excel software. Means, standard deviations, standard errors of the means and the statistical significance were determined by using GraphPad InStat (GraphPad Software Inc, San Diego, CA). One-way analysis of variance (ANOVA) was applied to determine the statistical significance between the means of the three independent groups for each analyzed variable as detailed in the results section. A p-value of ≤ 0.05 was considered significant.

Donors inclusions

Age of the donor between 18 - 60, genetically or emotionally related to the recipient, the remaining liver volume > 30%, BMI < 30, fat content < 10% in adult, < 40% in pediatric, identical or compatible blood group in adult and in pediatric above > 2 years, no major abdominal surgery, Contraception must be stopped at least 3 weeks; Smoking must be stopped at least 2 weeks and no anatomical variations, which need surgical reconstruction in donors.

Results

A total of 305 completed liver transplantations; 228 LDLT and 77 DDLT were done between 1/2011 to12/2013, in KFSH&RC. In the LDLT group: 125 (55%) transplants were done for adults and 103 for pediatric recipients. The donors were mostly males, 69% (n = 157). Age ranges between 18 and 42 years with the median=27.4 years (Tables 1 and 2).

The total donors' morbidity was 13.6% in the period from 1/2011 to 12/2013, 31 donors had 37 complications. Morbidity per year was 10.6% in 2011 (7/66), 22.4% in 2012 (17/76) and 8% in 2013 (7/86). Most of the complications were mild to moderate and 73% of all complications were Clavien I or II, 7 complications graded as Clavien I and 20 as Clavien II, no complications of Clavien grade IV (Tables 3 and 4). There was no donor mortality.

The grafts were 52% RL (n = 118), 41% LLS (n = 94) and 7% LL (n = 16), (Figure 3), with morbidity rates 13.6%, 12.8% and 18.8%, respectively in (2011 - 2013).

Biliary complications were the most frequent morbidities in living liver donors, 17 out of 37; making 45.9% of all morbidities with no difference in incidence between LLS donation (7/94), RL donation (9/118) and LL donation (1/16), 7.4%, 7.6% and 6% respectively (Figure 4).

	Adults Transplants	Pediatrics Transplants	Total
Sons	59 (47% of adult Tx)	NA	59 (26%)
Mothers	0	35 (34% of pediatric Tx)	35 (15%)
Fathers	0	32 (31%)	32 (14%)
Daughters	19 (15%)	0	19 (8%)
Cousins	8 (6%)	10 (9.7%)	18 (7.8%)
Brothers	10 (8%)	1 (0.97%)	11 (4.8%)
Sisters	2 (1.6%)	9 (8.7%)	11 (4.8%)
Nephews	11 (8.8%)	0	11 (4.8%)
Uncles	2 (1.6%)	8 (7.8%)	10 (4.4%)
Other relative	9 (7%)	9 (8.7%)	18 (7.9%)
Non-related	2 (1.6%)	2 (1.9%)	4 (1.8%)
Total	125	103	228

Table 1. Relation between Donors and Recipients of LDLT Operations Performed at King Faisal Specialized Hospital and Research Center (KFSH and RC) from 1/2011 to 12/2013.

Tx: Transplantation

Donors Characteristics = 228	LLS = 94	LL = 16	RL = 118	P-Value
Gender Female (31%)	36 (38%)	5 (31%)	30 (25%)	P < 0.13
Male	58	11	88	
Age (Y) Mean	30	27.8	26.1	P < 0.17
Range	18 - 42	20 - 39	18 - 41	
BMI (Kg/m2) Mean	25	25	23.4	P < 0.60
Range	15 - 34	18.7 - 32.3	17 - 30	
Post op Stay (day) Mean	4.8	5.1	6	P < 0.24
Range	3 - 12	4 - 6	4 - 14	
Graft WT (gm.) Mean	247	422	720	P < 0.0001
Range	125 - 400	285 - 675	396 - 1168	
Remaining Liver Volume % Mean	81	69	37.7	P < 0.0001
Range	70 - 89	61 - 74	30 - 48	
OR Time (min) Mean	245	325	364	P < 0.0001
Range	106 - 390	150 - 470	240 - 577	
OR Blood Loss, EBL (ml) Mean	207	341	369	P < 0.07
Range	50 -500	100 - 750	120 - 1200	

Table 2. Characteristics of Living Liver Donors Performed at KFSH&RC from 1/2011 to 12/2013.

No	Clavien	No of Morbidities	Morbidity %
1	I	7	19%
2	II	20	54%
3	III	10	27%
4	IV	0	0

Table 3. Donor Morbidity Stratified by Clavien Classification.

N	Morbidity	LLS = 94	LL = 16	RL = 118	Total = 228
1	Bile Leak	7 (7.4%)	1 (6%)	9 (7.6%)	17 (7.5%)
2	Incisional Hernia	2 (2%)	1 (6%)	1 (0.8%)	4 (1.8%)
3	Renal:				2 (0.9%)
	- UTI			1 (0.8%)	
	- Retention of Urine		1 (6%)		
4	Wound:				3 (1.3%)
	- Infection			2 (1.7%)	
	- Keloid			1 (0.8%)	
5	PVT			1 (0.8%)	1 (0.4%)
6	Chest:				4 (1.8%)
	- Infection			2 (1.7%)	
	- Effusion (Rt.)			2 (1.7%)	
7	Intra-abdominal:				4 (1.8%)
	- Hematoma	1			
	- Collection	1		2	
8	GI (Gastritis)	1			1 (0.4%)
9	SBO	1			1 (0.4%)

Table 4: Morbidity of Living Liver Donors performed at King Faisal Specialized Hospital and Research Center from 1/2011 to 12/2013 by Liver Lobes and Clavien Classifications.

SBO: Small Bowel Obstruction

Right donor hepatectomy was not followed by a higher morbidity rate than left hepatectomy or left lateral segmentectomy (P < 0.81).

Discussion

Historically, most organs for transplantation came from cadavers, but as these have failed to meet the growing need for transplantation, attention has turned to organs from living donors [6]. The first attempt to use a live donor for liver transplantation was done by Raia in Brazil (1987), who established the technical feasibility of the procedure although the recipient (a child) did not survive [7]. In the same year, Strong completed the first successful live donor liver transplantation (pediatric) in Australia [8]. Broelsch established and then refined the techniques in1988 [9]. This forward step in liver transplantation helped to decrease the mortality rate in pediatric transplant waiting lists, which was exceeding 25% [9,10]. In Asia, because there is a limited availability of deceased donors due to cultural reasons; there is strong motion towards LDLT. The world first adult LDLT was done in Japan in 1994 [11]. This trend was moved to the west [12,13]. With advanced surgical techniques and experience, living donor liver transplantation has become widespread. The live donor procedures are considerably more complex than whole organ deceased donor transplantation and there are unique considerations involved in the assessment of any specific recipient and donor. Donor selection and evaluation have become highly specialized.

Liver transplantation is growing fast in Middle East, the first liver transplant (adult cadaveric LT) in Saudi Arabia was done on 30 of July 1990 [14], in Riyadh Armed Forces Hospital. The start of living donor liver transplant (LDLT) program was in the same hospital in1998 [15], by doing pediatric LDLT. Outside Japan and Korea, Saudi Arabia became one of the largest countries performing LDLT. Therefore, we carried out this retrospective review, spanning three years duration 1/2011 to 12/2013, with 228 LDLT.

Our study (2011-2013) showed steady increase in the numbers of LDLT cases performed in KFSH & RC by more than 10% yearly. More than half (52%) of the grafts were RL (right lobe) (no = 118), 41% of the grafts were LLS (left lateral segments) (no = 94) and 7% LL (left lobe) grafts (7%).

Donors of LLS (no = 94) had 13 complications in 12 donors with morbidity incidence of 12.8%, more than half of them were biliary (7/13) and 46% were Clavien II (6/13). In the LL group, there were 3 complications in three donors. 16 Donors had 21 complications in RL donors with morbidity incidence of 13.6%; (16/118), bile leak incidence was 43% (9/21) and 62% of RL donors' complications were Clavien II (13/21) (Table 5). 27% of all donors' complications were Clavien III (10/37), 5 donors were re-operated; 4 for incisional hernia repair and the 5th donor was operated by plastic surgery for a keloid. Only one event of thromboembolism; portal

vein thrombosis (PVT) with moderate portal hypertension, which was managed successfully conservatively, complicated a RL donor. No donor morbidity reached Clavien grade IV. There was no donor mortality in our study.

	LLS = 94	LL = 16	RL = 118	P-Value
Clavien I	5 (38%)	1 (33%)	1 (5%)	P < 0.13
Clavien II	6 (46%)	1 (33%)	13 (62%)	P < 0.46
Clavien III	2 (15%)	1 (33%)	7 (33%)	P < 0.38
No of Morbidities	13	3	21	P < 0.71
No of Donors	12	3	16	P < 0.81
Morbidity %	(12/94) = 12.8%	(3/16) = 18.8%	(16/118) = 13.6%	P < 0.81

Table 5: Donors Morbidities for each Graft Type with their Clavien Incidence %.

LLS: Left Lateral Segment; LL: Left Lobe; RL: Right Lobe.

Our results showed that right donor hepatectomy does not result in increased morbidities than other smaller heptectomies (left lateral segment, left hepatectomy) (Table 4 and 5), this is in keeping with results published from some centers from Asia and Europe [16,17]. Most of the literatures revealed more donor morbidities with RL donors [18,21]. This improvement in favor of right hepatectomy could be the result of increasing experience of the transplant centers especially the surgical techniques. Extensive center and surgeons experiences make a difference, this is evident by the study of a single center in Turkey of 500 LDLT, where extensive experience in RL donor hepatectomy (91.2% of the total donors) resulted in less complications in RL donors (LL donor complications 36.7%, RL 18.6% and LLS 10%) [22].This data is supporting the evidence regarding the safety of right hepatectomy especially in situation where small for size (SFS) is a potential concern.

Conclusion

This study reiterates the safety of donor hepatectomy as a solution to expand the liver transplantation donor pool. Right donor hepatectomy did not have a higher morbidity rate compared to left hepatectomy or left lateral segmentectomy (P < 0.81). Complications were relatively minor and easily controlled. Nearly half of morbidity related to biliary complications. Complete prevention of donor complications is not feasible, but donor risk must be minimized to an acceptable degree. Right hepatectomy is safe and is not associated with more morbidity than left lateral or left hepatectomy.

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