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Open Donor Nephrectomy: A Tertiary Hospital's Experience, Is Laparoscopic Donor Nephrectomy Superior?

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Abstract

Objective: The aim of this study is to evaluate our experience of Open Donor Nephrectomy (ODN) in a low volume tertiary centre and review the literature to compare the efficacy with those of Laparoscopic Donor Nephrectomy (LDN) and ODN performed in other centres.

Patients and Methods: We retrospectively analysed all cases of open donor nephrectomy performed in our institution over a 5-year period and collected relevant data.

Results: There were 30 males and 10 females with a mean age and BMI of 35.9 years and 26.7 respectively. The left kidneys were retrieved in 75% of the cases and 90% of the kidneys had 1 renal artery, the rest having 2 arteries. The mean Warm Ischaemia Time (WIT), operating time and mean length of hospital stay were 3.4 minutes, 212 minutes and 3.9 days respectively. Three patients had Clavien grade 3 complications and were treated by simple measures, 2 patients had Grade 1 complications.

Conclusions: The efficacy of both ODN and LDN appear to be similar with minor differences in the advantages and disadvantages of the two techniques. However, there are inherent risks of more serious complications when performing LDN in low volume centres.

Introduction

There has been an increasing trend towards the use of less invasive techniques such as laparoscopy over the years and retrieving kidneys from living donors for renal transplantation has been no exception. Despite the well-established trend, controversy still remains over the advantages and disadvantages of laparoscopic donor nephrectomy compared to open donor nephrectomy especially in lower volume centres [1]. In this retrospective study we present our experience of a tertiary referral hospital where only open donor nephrectomies were performed and reviewed the relevant literature for comparison.

Material and Methods

In our institution only live donor transplants have been performed because of the difficulty in obtaining cadaveric kidneys. All patients who had live donor nephrectomy between May 2013 and May 2018 were included in this retrospective study excluding one patient who had incomplete documentation. The patients' demographics are shown in [Table 1].

All donors underwent careful preoperative assessment by a multidisciplinary team with the guidance of the nephrologists before a decision was made to proceed with the surgery. Patients underwent 3-dimensional computed tomographic angiography and isotope renography to evaluate the kidneys and vascular tree as well as the presence of any other abnormality. The basic principle of leaving the donor with the better kidney was strictly adhered to on all occasions.

A standard open donor nephrectomy was performed as described by M.Y. Lind [2]. Adequate intravenous hydration is a prerequisite to the surgery. With the donor placed in a lateral decubitus position, a lumbotomy incision 12 to 15 cm in length was performed usually with resection of 11th or 12th rib. Intravenous mannitol was given as soon as the kidney dissection was started. In the event of renal artery spasm topical papaverin was applied. The ureter is dissected with its periureteric tissue and then divided and ligated distally. The kidney was then removed and perfused with ice cold perfusion solution.

Patient demographics: (No. of patients 40)	
Age (Mean)	35.95 years (range 20-55)
Sex	M 30 (75%) : F 10 (25%)
BMI (Mean)	26.68 (range 20-32)
Side selection	Left 30 (75%) : Right 10 (25%)
No of Arteries	One in 36pt ; Two in 4pt

Table 1: Patient demographics.

Results

The results of 40 open donor nephrectomies performed over a period of 5 years are outlined in Tables 2 and 3 . There were 30 males and 10 females with a mean age and BMI of 35.9 years and 26.7 respectively. The left kidneys were procured in 75% of the cases and 90% of the kidneys had 1 renal artery, the rest having 2 arteries. The mean WIT and operating time were 3.4 minutes and 212 minutes respectively. The mean hospital stay was 3.9 days and only 3 patients had Clavien grade 3 complications, they were treated with simple measures as shown in (Table 3). Urethral stricture developed as a late complication in 1 patient and 2 patients had Grade 1 complications.

Clinical parameters: (No. of patients 40)	
Warm ischemia time (Mean)	3.4 min (range 2 – 6 min)
Operating time (Mean)	212 min (range 147 min – 300 min)
Pre-operative Hb (Mean)	13.93 g/dl.
Post-operative Hb (Mean)	11.87 g/dl.
Hospital stay (Mean)	3.9 days (range 2 – 7 days)

Table 2: Clinical parameters.

Complications. (No of patients 40)			
Complications:	**No**	**Treatment**	**Clavien-Dindo classification-Grade**
Atelectasis	2	Chest physiotherapy	I
Pneumothorax	1	Intercostal drainage	III a
Wound haematoma	1	Evacuation	III b
Stricture urethra	1	Optical urethrotomy	III b

Table 3: Complications.

Discussion

The duration of warm ischemia time which can lead to irreversible cellular damage has come into question recently [3]. In renal transplantation, all efforts are taken to keep WIT to as near zero as possible in contradiction to the traditional 30 minutes accepted for partial nephrectomy [4]. However, there are studies in which LDN have recorded the duration of WIT of up to 15 minutes [5]. The scientific evidence governing duration and effect of ischemia on the kidney is an arbitrary time-point which was not based on clinical outcomes [4].

Delayed renal function in the early phase is often seen in recipients receiving kidneys by the laparoscopic technique compared to open surgery. This is mainly attributed to the longer WIT during laparoscopic surgery [6-8] furthermore the pneumoperitoneum created during laparoscopy affects the renal haemodynamics negatively [9-12]. Equivalent early renal function after both LDN and ODN has also been reported [13,14], reinforcing the doubts surrounding the early functioning of grafts [15]. However, the delayed renal function did not persist beyond the first month and did not achieve statistical significance in all the studies [6,7,16-19].

Delayed renal function and ATN are multifactorial, not solely related to WIT. In some studies, the duration of the anastomosis was the main predictor of delayed graft function and this was identified as the strongest independent predictor of delayed graft function [20].

Due to the technical difficulties in procuring the right kidney laparoscopically, surgeons tend to utilize the left kidney despite having vascular anomalies [16], leaving the suboptimal kidney with the donor [21]. The more technically complex right-sided LDN is associated with an increased incidence of graft failure secondary to renal vein thrombosis [22].

In a study in which 320 patients who underwent LDN, the left kidney was removed in 97.5% of the patients compared to 2.5% from the right [23]. This ratio is strikingly different from the left to right ratio recorded in several series of ODN, ranging from 26 - 37% [24]. And 25% in this study. Learning the technique of LDN is a major technical challenge in low volume centres. In one study it was found that after an experienced laparoscopist has performed 37 LDN, there is a significant decrease in the operating time and incidence of delayed graft function [25]. The steep learning curve and lower patient volumes may compromise the outcomes and benefits of LDN including less post-operative pain and quicker convalescence [26].

The 2018 British transplant guidelines state that despite the fact that the vast majority of donor nephrectomies in UK are carried out using minimally invasive techniques, the differences or advantages between the techniques are minor and surgery should be performed according to the surgeon's proficiency in the technique [27].

Three patients in this study, 7.5% had Clavien grade 3 complications which were managed by simple measures (Table 3). Both techniques have been documented to have low complication rates [28,29]. However, a study of LDN reported 44% less risk of perioperative complications in higher volume centres, (>50cases per year) as opposed to mid volume centres, (11-50 cases) [30]. Similar findings have been documented showing twice the risk of perioperative complications when comparing centres performing <50cases/year and 100cases/year [31]. At least eight perioperative deaths associated with LDN have been reported in the literature. A review by Shokeir comparing the morbidity and mortality in ODN and LDN, concluded that laparoscopy has the disadvantages of increased operating time, increased WIT and increased major complications requiring re-operations [32]. This emphasizes the need for high volume centres in order to maintain skills and safety standards.

The length of Hospital Stay (LOS), is often considered a measure of post-operative recovery. However, this may vary according to institutional practices rather than surgical techniques. The LOS after ODN in well-known American medical institutions varies from 2 to 4 days as opposed to 3 to 4 days in LDN [24]. In this study, the average LOS was 3.9 days which compares favorably to the studies above. The role of Enhanced Recovery pathways has yet to be established in ODN, however other surgeons performing major abdominal surgery have adopted these principles allowing for quicker post-surgical recovery. These practices are readily transferable to ODN [27].

Laparoscopy has led to a greater interest in cosmesis after open surgery which has resulted in improvements by shortening the incisions [33]. The transcostal postero-lateral flank incision of ODN was miniaturized to between 12 - 15 cm making it less visible when viewed anteriorly. LDN requires 3-4 port incisions and a lower abdominal transverse retrieval incision, all noticeable anteriorly. There is no evidence to support beneficial wound healing in either surgical procedures and it is debatable which appearance is more cosmetically acceptable [34].

Conclusion

The efficacy of both ODN and LDN appear to be similar with minor differences in the advantages and disadvantages of the two techniques. However, there are inherent risks of more serious complications when performing LDN especially in low volume centres. The caveats for LDN include a longer WIT and steeper learning curve. Even the long-heralded benefits of laparoscopy such as a shorter length of hospital stay and cosmetic appearance can be challenged. Surgeons should perform live donor nephrectomy by the technique they are trained most proficiently to undertake.

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2. Ethical approval for this study was obtained from the Scientific Research Committee of the Royal Hospital, Muscat, Oman. The unique identification code is MoH/CSR/18/9399
3. Informed consent was obtained for this study from the patients included in this manuscript.
4. The study was done in accordance with the relevant guidelines and regulations pertaining to the Declaration of Helsinki.

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