Hand-assisted Laparoscopic Donor Nephrectomy and Cytokine Changes

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ABSTRACT

Background. Laparoscopic living-donor nephrectomy (LDN) exerts systemic effects causing transaminitis and increased urinary neutrophil gelatinase-associated lipocalm (NGAL) excretion. Hand-assisted laparoscopic donor nephrectomy, which tends to be shorter with less pneumoperitoneum, may be hypothesized to produce less systemic stimulation than total laparoscopic LDN.

Methods. Serial urine and serum samples were collected from 15 patients undergoing HALDN. Samples were analyzed for NGAL and kidney injury molecule 1 (KIM-1) levels preoperatively and 24 hours post-surgery. Data relating to alanine aminotransferase, creatinine, and estimated glomerular filtration rate was also analyzed in 48 live donors preoperatively and at 24 hours and 48 hours post-surgery and compared to published data on LDN.

Results. Expected changes to creatinine and estimated glomerular filtration rates were observed in the donors. Compared to the preoperative levels, alanine aminotransferase levels showed a significant decrease at 24 hours ($P = .004$) and were not significantly different from baseline levels at 48 hours ($P = .08$). Serum KIM-1 and NGAL levels remained unchanged ($P = .89$ and $P = .14$, respectively) at 24 hours after donation. Similarly, urinary levels of KIM-1 and NGAL were not statistically significantly different after donation. Mean operating time for this cohort was 1 hour, 36 minutes.

Conclusions. In contrast to other published data, our cohort did not exhibit changes to liver function tests or biomarker changes after donor nephrectomy. This could be because of the lower operative time (96 minutes vs. 216 minutes) or because of the intermittent release of the pneumoperitoneum in the hand-assisted method which may exert less of a systemic inflammatory response.

TRANSPLANTATION is well recognized as the "gold standard" treatment for those patients with end-stage renal failure. The drive to increase kidney transplantation in the United Kingdom has led to the championing of live-donor transplantation to compensate for the lack of organ donors.

The approach to donor nephrectomy has evolved from the traditional open method to different laparoscopic approaches including both totally laparoscopic and hand-assisted laparoscopic donor nephrectomy (HALDN). Particularly, this has been due to the faster recovery and improved acceptability of laparoscopic donation, which has also translated to improved quality of life outcomes [1].

It is critical that donor nephrectomy is as safe as possible for donors as it is a unique procedure during which surgery is performed for no direct medical benefit to the individual.

Recent research has suggested that a totally laparoscopic method of donor nephrectomy may cause elevation of

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cytokine and liver enzyme levels as part of a systemic inflammatory response [2].

Another study examined the biomarker changes that occur in both high- and low-intra-abdominal–pressure laparoscopic donor nephrectomy, based on the suggestion that renal function is highly susceptible to intra-abdominal pressure [3]. This study showed no difference in biomarker profile between the high- or low-pressure approaches. It did, however, show a transient intraoperative increase in kidney injury molecule 1 (KIM-1) levels and a slow subtle increase in neutrophil gelatinase-associated lipocalm (NGAL) levels at day 2 postoperation [4].

The changes accompanying HALDN have not previously been studied. The aim of the study was to elucidate whether HALDN produced similar changes to those previously reported in totally laparoscopic nephrectomy.

To determine the effect of surgery on the remaining kidney, two markers of acute kidney injury were also analyzed. KIM-1 is a transmembrane glycoprotein that is expressed in the proximal tubule whose urinary levels have been shown to increase markedly in the setting of acute kidney injury [5,6]. NGAL has similarly been shown to correspond well to the degree of damage in patients with acute kidney injury [7,8].

MATERIALS AND METHODS

Patient Recruitment

The study protocol was approved as part of a larger study by the National Research Ethics Committee (REC approval: 10/H1206/65). Fifteen patients undergoing left-sided laparoscopic donor nephrectomy were studied for analysis of NGAL and KIM-1 biomarker level changes, and 48 patients were identified for routine blood biochemistry analysis.

HALDN was performed as previously described using a 5- to 6-cm incision to admit the hand but without using a hand-port device [9]. All operations were performed under standard anesthetic protocols.

Serum and urine were collected preoperatively before the induction of anesthesia and at 24 hours and 48 hours postoperatively. Specimens were aliquoted and stored at −80°C until analysis.

Routine biochemical and hematological analysis of samples was performed within the respective laboratories of the Queen Elizabeth Hospital Birmingham including creatinine, estimated glomerular filtration rate (eGFR), and alanine transaminase (ALT) as part of routine clinical care. Serum and urine analysis of NGAL and KIM-1 was performed using a Luminex assay with matched antibody pairs (R&D, Minneapolis, Minnesota, United States) [10].

Table 1. Baseline Characteristics of the Two Patient Populations

Characteristic	Biomarker Cohort (n = 15)	Lab-based Cohort (n = 48)
Age, y (mean)	51	44.1
Male (%)	40	44
Operative time, min (mean)	104	96
Baseline		
Creatinine, mmol	72	70
eGFR, mL/min	80	86
ALT, U/L	20	20

Abbreviations: eGFR, glomerular filtration rate; ALT, alanine aminotransferase.

Statistics

To determine whether significant changes had occurred to the analytes, a paired *t* test (Wilcoxin matched pairs) was performed. A value of $P < .05$ was considered statistically significant.

RESULTS

The baseline characteristics of the 15 donors used for biomarker analysis and the 48 donors used for analysis of creatinine, eGFR, and ALT is shown in Table 1 and are similar between the two groups.

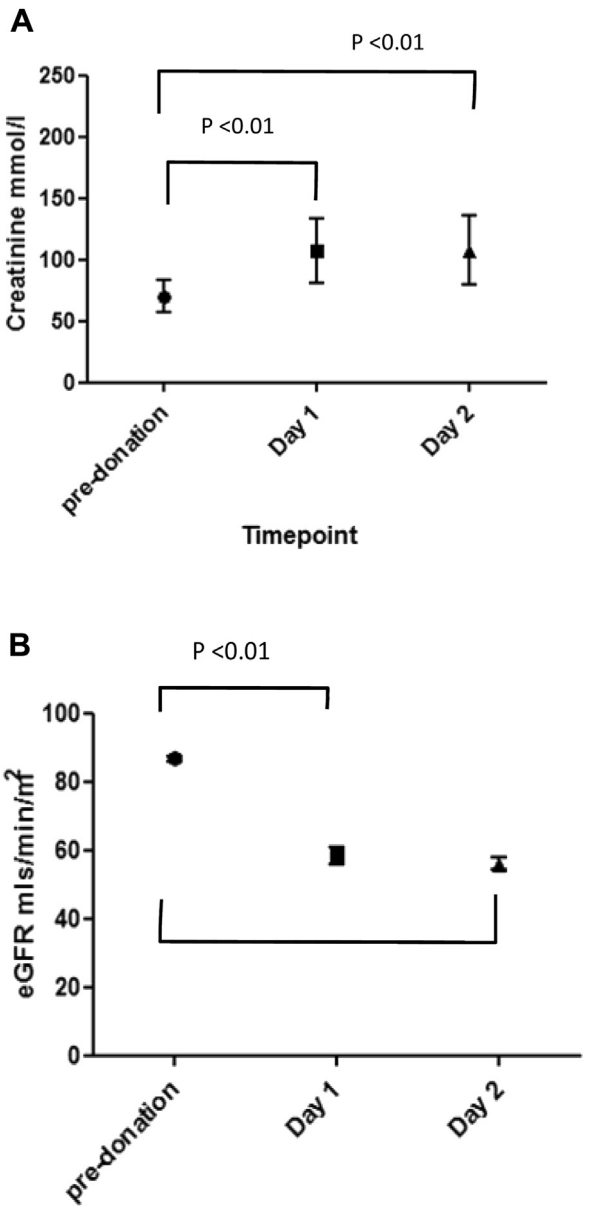

Fig 1. Changes to (**A**) creatinine and (**B**) estimated glomerular filtration rate (eGFR) at 24 hours and 48 hours post-donation compared to pre-donation levels (n = 48).