

*Short Communication***Neutrophil-Gelatinase Associated Lipocalin (N-GAL) to Assess Perioperative Acute Kidney Injury in Hand-Assisted Laparoscopic Donor Nephrectomy: A Pilot Study**Emma Aitken¹, Alex Vesey¹, Julie Glen¹, Mark Steven² and Marc Clancy¹¹Department of Renal Surgery, ²Department of Anaesthetics, Western Infirmary, Dumbarton Road, Glasgow**Abstract**

Perioperative insults, including hypotension, hypovolaemia and pneumoperitoneum may occur during laparoscopic live donor nephrectomy. These may have deleterious effects to both donor and recipient. The extent and significance of these insults is poorly understood and difficult to quantify. The aim of this study was to evaluate acute kidney injury (AKI) in the donor using the novel biomarker neutrophil-gelatinase associated lipocalin (N-GAL). We report the results of a pilot study of 20 patients undergoing hand-assisted live donor nephrectomy. eGFR and serum NGAL measurements (Triage CardioRenal Panel, Alere) were obtained pre-operatively, immediately post-operatively, day 1 and 6 weeks post-operatively. Mean pre-operative eGFR was 105.6+/-10.1ml/min/1.73m². Mean eGFR 6 weeks post-operatively demonstrated a 29.4+/-8.8% reduction from baseline. Serum N-GAL increased by 34.1+/-16.7% following an overnight fast pre-operatively (day 0) (Δ NGAL 45.1+/-36.0ng/ml), by a further 14.9+/-7.2% following surgery (immediate post-op). The largest Δ NGAL was observed during the pre-operative fasting period. Δ N-GAL [day -1 to day 0] and [day -1 to post-op] were found to correlate inversely with eGFR at 6 weeks ($p < 0.05$, $r^2 = 0.47$ and $p < 0.001$, $r^2 = 0.52$ respectively). We conclude that clinically significant AKI does occur in the donor following live donor nephrectomy. Optimisation of perioperative fluid management is likely to have a protective role.

Key words: acute kidney injury, biomarkers, donor nephrectomy, renal transplantation, living donor, N-GAL, graft outcome

Introduction

Perioperative insults, including hypotension, hypovolaemia and pneumoperitoneum, which may occur during laparoscopic live donor nephrectomy can have deleterious

effects to both donor and recipient. The extent and significance of these insults is poorly understood and difficult to quantify. Delayed graft function is uncommon following live donor renal transplantation, nevertheless a degree of acute kidney injury (AKI) in the recipient is well-recognized [1,2]. Similarly, in other laparoscopic abdominal surgery, pneumoperitoneum is known to be associated with adverse renal haemodynamic effects and acutely decreased urine output of the native kidneys [3]. The degree of acute tubular injury in the donor however has not previously been evaluated.

Until recently, a lack of sensitive biomarkers for AKI has made assessment of perioperative renal insults in the donor difficult, with any subtle changes in serum creatinine masked by the overwhelming effect of nephrectomy itself. Neutrophil-gelatinase associated lipocalin (N-GAL) is a novel biomarker of early AKI which has previously been demonstrated to be predictive of morbidity and mortality following cardiac surgery and in polytrauma [4,5]. The aim of this study was to evaluate acute kidney injury (AKI) in the donor using the novel biomarker N-GAL.

Material and methods

We report the results of a pilot study of 20 patients undergoing hand-assisted live donor nephrectomy. eGFR and serum NGAL measurements (Triage CardioRenal Panel, Alere) were obtained pre-operatively, immediately post-operatively, day 1 and 6 weeks post-operatively. Data on perioperative fluid balance was also collected. Results are presented as mean+/-S.D.

Results

Mean donor age was 40.6+/-11.1 years (65% male). Mean pre-operative eGFR was 105.6+/-10.1ml/min/1.73m². Day 1 post-op mean eGFR was 65.7+/-10.4 ml/min/1.73m² (37.7+/-9.2% reduction from baseline) and mean eGFR 6 weeks post-operatively was 74.1+/-8.6ml/min/1.73m² (29.4+/-8.8% reduction from baseline). Pre-operative fluid

loading was undertaken as was surgeon preference. Mean pre-operative intravenous fluid volume administered was 2245 \pm 1112.4ml in the 12 hours prior to surgery.

Mean intra-operative intravenous fluid volume was 1175 \pm 466.6ml.

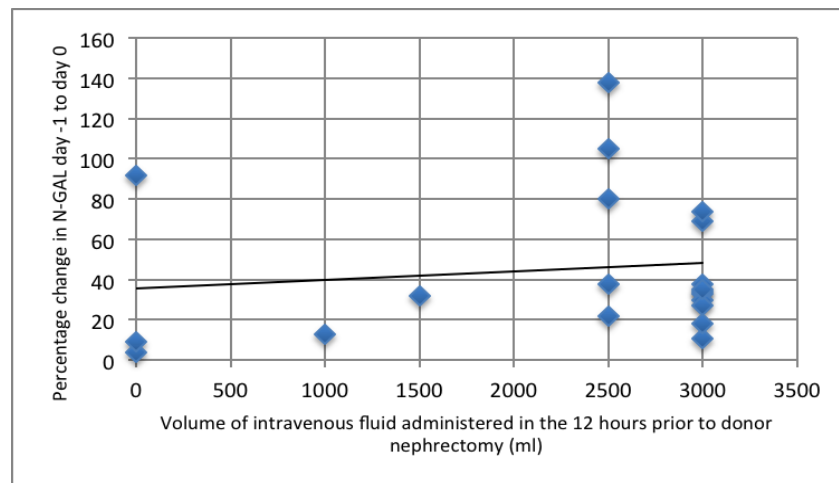


Fig. 1a. There was no association between the volume of intravenous fluid administered in the 12 hours pre-operatively and Δ N-GAL perioperatively

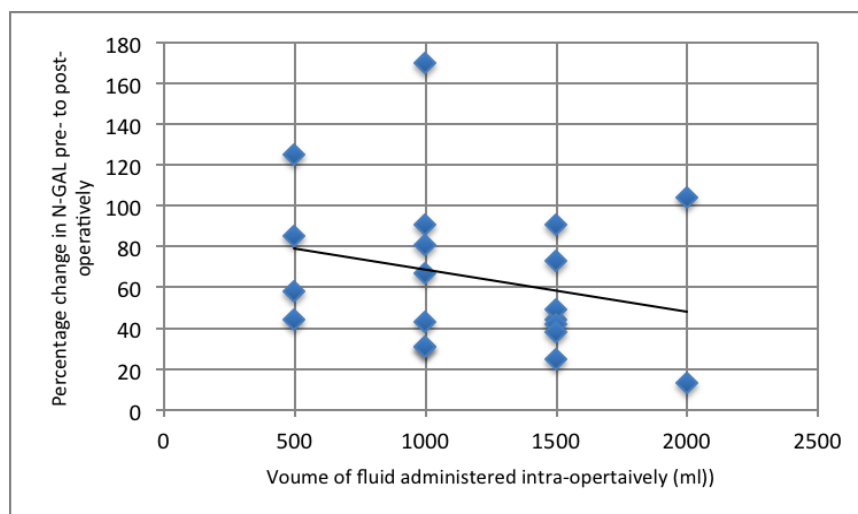


Fig. 1b. There was a trend towards liberal intra-operative fluid regimens resulting in smaller Δ N-GAL perioperatively

Mean pre-operative N-GAL was 72.2 \pm 14.0ng/ml (normal: <153ng/ml) on the evening prior to surgery (day-1). Serum N-GAL increased by 34.1 \pm 16.7% following an overnight fast pre-operatively (day 0) (Δ NGAL 45.1 \pm 36.0ng/ml), by a further 14.9 \pm 7.2% following surgery (post-op) and a further 3.1 \pm 1.2% by post-operative day 1. The largest Δ NGAL was observed during the pre-operative fasting period. Δ N-GAL [day -1 to day 0] and [day -1 to post-op] were found to correlate inversely with eGFR at 6 weeks (p <0.05, r^2 =0.47 and p <0.001, r^2 =0.52 respectively). No association was seen between pre-operative fluid balance and Δ N-GAL (Figure 1a), however liberal intra-operative fluids may be protective against post-operative AKI (Figure 1b).

Discussion

We conclude that clinically significant AKI does occur in the donor following live donor nephrectomy. This can be difficult to quantify using standard biochemistry due to the overwhelming effect which nephrectomy itself has on eGFR and serum creatinine. Perioperative AKI is associated with poorer donor eGFR at 6 weeks. Peri-operative hypovolaemia appears to play a significant role in the development of donor AKI. Optimisation of perioperative fluid management is likely to have a protective role.

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Conflict of interest statement. None declared.

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