

Keywords: Kidney transplantation; Kidney donor side; Deceased

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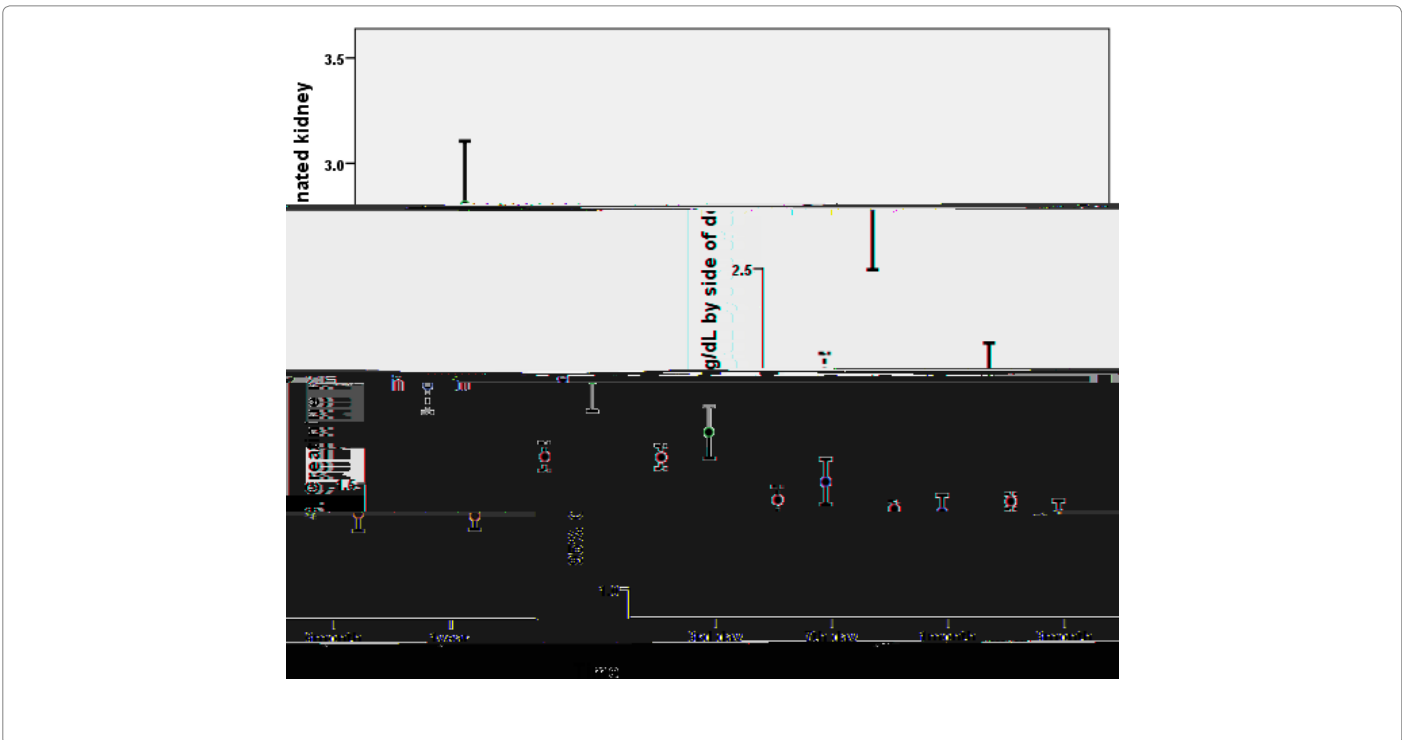
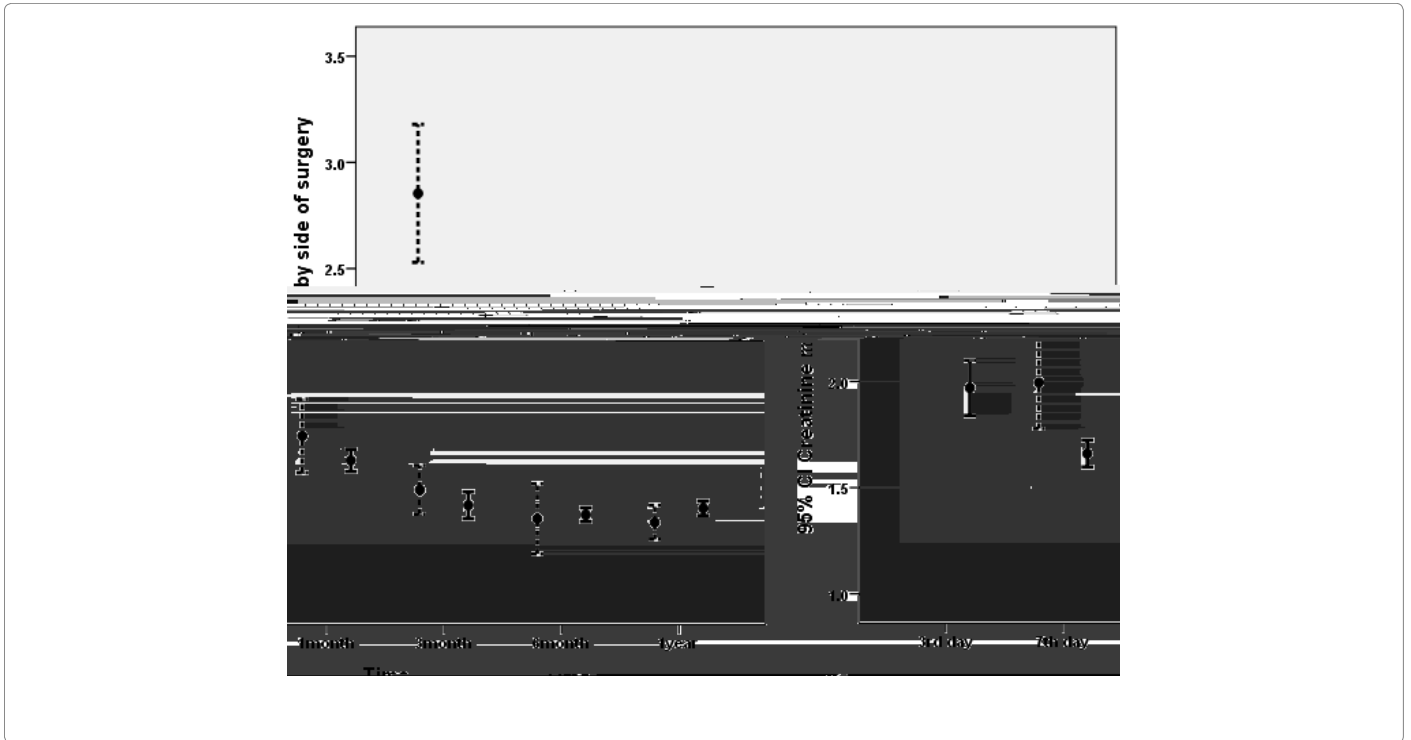
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department has been left side laparoscopic donor nephrectomy but in some cases right side nephrectomy and same side or inverted kidney transplantation has been performed based on patients' situations. The allograft transplant was accomplished by anastomosis of the renal artery to the internal iliac artery or to the external or common iliac arteries when the internal was not appropriate. The renal vein in just about all patients was anastomosed to the external iliac vein. Aorta and inferior vena cava were the locations of vascular anastomosis in small pediatric recipients. Suture material was prolene 6-0 and 5-0 for vascular anastomosis. Ureteral anastomosis was done within modified Lich technique using ureteral stent. All transplantations were implemented by the team ran by three transplantation urologists (N.S., A.B. and A.T.).

Immunosuppression was similar and patients received Calcineurin inhibitor-based immunosuppression.

Serum creatinine was measured at postoperative days during hospitalization and then at follow up appointments. Serum



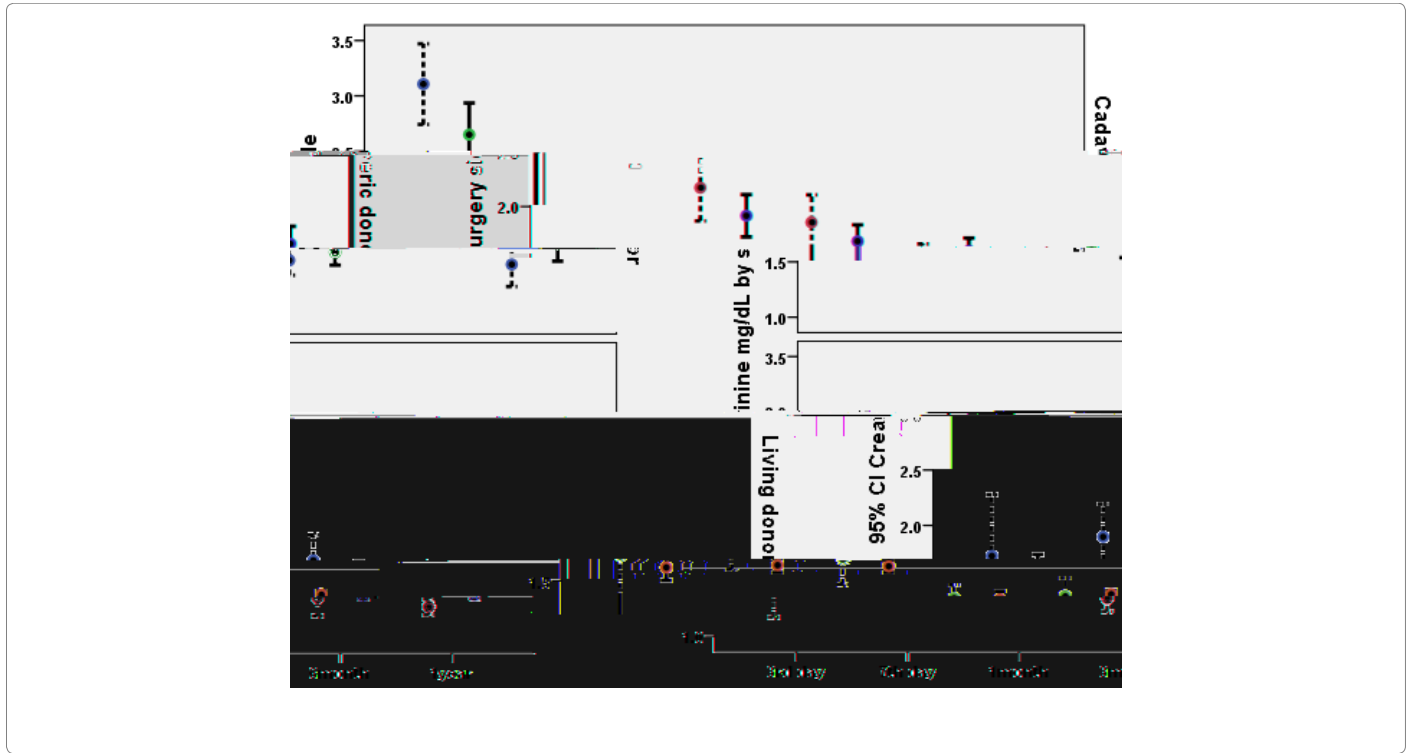
For transplantations from the right side of the donor, serum creatinine in the 3rd and 7th postoperative days were higher when kidney was transplanted into the left side of the recipient ($P < 0.001$ and $P = 0.05$ respectively). This statistically significant difference in 3rd and 7th day postoperative creatinine with respect to transplantation side was no longer observed in the 1st month after operation and thereafter. However, the frequency of transplantations from living donors was

99% when the kidney was implanted in the right side of the recipient versus only 61% living donors when the kidney was implanted in the left side of the recipient ($p < 0.001$).

As the sequence of 1st, 2nd and 3rd transplantations was different between right and left implantations; and also to remove the potential confounding effects of donor and recipient age; we performed a linear regression analysis with enrolling potential confounders including

	30 years			
	>30 years			
	40 years			
	>40 years			

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donor age, recipient age, and sequence of transplantation with side of implantation into the model. The results of the regression model outlined in Table 3, indicates the lack of significance of side of surgery after enrolment of the above mentioned confounders in the model. A second regression analysis was performed for donor side after enrollment of donor age, recipient age, and sequence of transplantation into the model, in this model the influence of donor side on 7th day

postoperative creatinine was still statistically significant after enrollment of the above mentioned variables. Briefly, left donated kidneys were associated with better 7th day postoperative creatinine in comparison with right donated kidneys. Due to co-linearity between donor side and side if implantation, we could not perform one regression taking both donor side and recipient side simultaneously into one model and separate models were used for each of them.

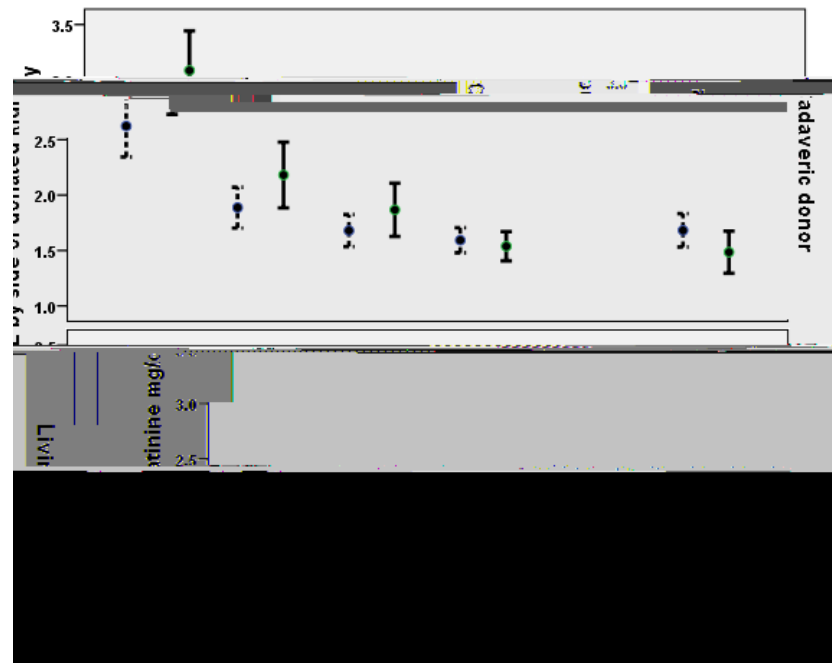


Figure 4:

Complications were observed in 170 patients and included: Death in 53 patients, rejection in 71 patients, hematoma in 3 patients, need for ureteral re-implantation in 19 patients, vein thrombosis in 17 patients, reactivation of tuberculosis in 2 patients, arterial thrombosis in 3 patients, lymphocele formation in 1 patient and kidney cancer in one patient. Table 2 summarized the frequency of complications based on the side of donated kidney, side of kidney implantation, and side of kidney implantation for right kidney donations. Complications in recipients according to the Clavien-Dindo categories (19) of 0, 2, 3b, 4a, 4b and 5 were observed in 89, 0, 1.1, 7.8, 0.6 and 1.7% of left implantations and 93, 0.3, 0.8, 2.7, 0.8, and 2.3% of right implantations ($p=0.007$). Clavien-Dindo grades 0, 2, 3b, 4a, 4b and 5 were observed in 91.4, 0.3, 0.8, 3.4, 1.0 and 3.1% of transplantations from left donor kidneys and in 87.5, 0.2, 1.1, 5.7, 1.9, and 3.6% of transplantations from right donor kidneys ($p=0.07$). It is noteworthy that failure of graft which terminated in recipient need for dialysis was considered as a grade 4a complication in our grading of Clavien-Dindo complications.

Discussion

We appraised the aftermath of right and left kidneys procured from the deceased and living donors. Recipients of left donated kidneys revealed better allograft short term function in terms of 7th day postoperative creatinine in the crude data. Recipients of right kidneys that transplanted in left side were more likely to experience low graft function within the first week after transplantation but after one month their outcome became similar to recipients of right kidney transplanted in right side. Because our data was inhomogeneous in age, type of donor (cadaveric or living, open nephrectomy or Laparoscopic donor nephrectomy) and sequence of transplantation, to remove mentioned confounding factors in first week effect, we performed regression analysis including all proved confounders in univariate analysis into the regression model. The result of this model revealed that donor side of kidney is yet statistically significant of 7th day postoperative creatinine while the side of implantation was not.

Vacher-Coponata et al. reported that recipients of right-sided kidneys obtained from heart-beating brain-dead donors are at higher risk of emerging delayed graft function, poorer graft function and higher risk of graft loss in the first year after transplantation.

The lengthier vein of the left kidney allows easier implantation without additional procedure. Nonetheless, right kidneys have longer arteries and give the impression to suffer risk of kinking. With shorter right renal vein may complicate venous anastomosis especially in obese recipients with deeper iliac vessels [7,11]. Also the frequency of anatomical variations in right kidney vessels is higher than the left, and these vessels are usually smaller in size which makes it prone to thrombotic complications [12,13] Many surgeons especially in open donor nephrectomy obtain a patch of inferior vena cava if possible that can be more challenging in laparoscopic donor nephrectomies although results of right laparoscopic donor nephrectomy in overall is same in comparison with the left side.

Johnson et al. reported 201 renal implantations and Salehipour et al. reported 60 recipients with a comparable delayed graft function proportion for right and left kidneys although the number of their patients is rather small. Similar findings have also been reported for laparoscopic living donor renal transplant operations.

Khalil et al. evaluated 58 599 living donor transplants and reported more delayed graft function and more vessel thrombosis in right kidney recipients with a hazard ratio of 1.38 and 1.48 although graft survival difference was little. They showed that laparoscopic conversion to open was more in right donor nephrectomy. While our study yields higher postoperative creatinine just in first week for right kidney transplantation in either side of recipient however becomes similar in first year. Lechevallier et al. in a retrospective study of 257 patients, advocated that delayed graft function is more prevalent in right kidney recipients [9,14-18,20,21].

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A review article by Phelan et al. revealed that delayed graft function were much higher during the 1990s at 25–30% but its rate gradually decreased to 16%. Up-to-date advances in kidney transplant management may have amended any shortfall accompanying with right-sided allografts and cleared different long-term results in current studies.

Although the exact reason cannot be proven, the anatomical differences between left and right kidney prejudice to a more difficult surgery, more anastomosis duration and extended warm ischemia time in case of transplantation from right kidneys. This phenomenon may explain our study results about inferior one-week outcome of right sided donated kidneys. Our crude results as explained in the results section reveals that when the right kidney is implanted in the right side of the recipient the outcome is superior than when it is implanted as suggested in the left side of the recipient. This could mean that in addition to difficulties with donor kidney explained above; recipient left side more is associated with a more difficult operation because of deeper iliac vessels. Interestingly for the left donor kidney, the crude data indicate that side of implantation was not associated with any difference in the postoperative function of implanted kidneys. This may because of longer left kidney vein and its easier anastomosis. Another possibility could be that the larger size of left kidney (146 cm³) versus right kidney (143 cm³) may compensate operational insults in the recovery period sooner [10,14,21]. Nonetheless, if right kidney transplanted in left side of recipient outcome will be similar with other groups in one year follow-up after first week inferiority (Table 4).

right donor kidneys were associated with higher 7th day postoperative creatinine in the recipients. Complications for side of donation or transplantation were not significantly different.

There are some limitations in this study. First, we accept the characteristic flaws of any single-center study. However narrowing the study to one center lessens the confounding effects of numerous peri-operative practices. We performed a linear regression analysis with enrolling potentially confounding variables including donor age, recipient age, comorbidities, and sequence of transplantation with either side of implantation or side of donations into two models to increase the validity of the conclusion. Second, the operating surgeons might have selected left and right kidneys based on patient situations. Although cold ischemia times in living donor groups were comparable, deceased donors may confound outcome. Although arithmetical modifications were prepared, the likelihood of enduring confounding cannot be totally omitted. Lastly, estimated glomerular filtration rate is more valuable than creatinine which we practiced in comparing result.

Conclusion

Our data suggest that side of donor or recipient surgery in kidney transplantation is not important in one year follow-up. However,

