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Update On Renal Consequences Of Left Renal Vein Division During Open AAA Repair: It Is Not Always Benign

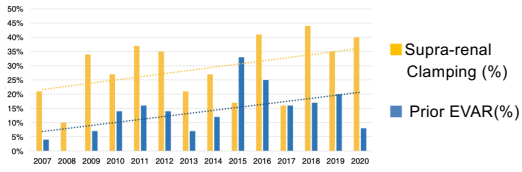
Kimihiro Komori, M.D., Ph.D., F.A.C.S
Emeritus Professor,
Nagoya University Graduate School
of Medicine

Disclosures

❑I do not have any potential conflict of interest

Annual change of the cases in the patients with supra-renal clamping OAR

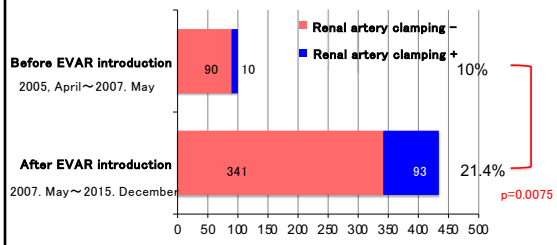
For patients whom EVAR is not anatomically indicated, open aortic aneurysm (OAR) repair is the first choice.
After EVAR introduction, OAR involved suprarenal clamping has increased.



Woodford C, et al. *J Vasc Surg*. 2022;76:1520-1526.

Percentage of Open Repair requiring renal artery clamping (Pararenal AAA)

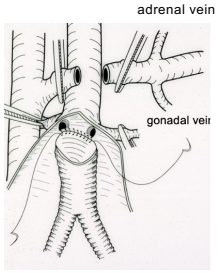
Sugimoto M, Komori K et al. J Vasc Surg 2017



" Renal artery clamping cases are increased after EVAR introduction "

Open repair requiring renal artery clamping (Pararenal AAA)

- Procedure of Dissection of Left Left Renal Vein -



- Suprarenal aorta was exposed,
- Left renal vein (LRV) was divided adjacent to the inferior vena cava at proximal region of adrenal and gonadal vein
- Closure of renal vein stump using 4-0 prolene running suture

Renal Artery Clamping and Left Renal Vein Division during Abdominal Aortic Aneurysm Repair

K. Komori,[1,2*] T. Furuyama[2] and Y. Maehara[2]

Eur J Vasc Endovasc Surg 27, 80–83 (2004)

Objectives. To determine whether renal artery clamping and division of the left renal vein affects renal function in the patients who undergo repair of infrarenal abdominal aortic aneurysm (AAA).

Methods. Between 1992 and 2000, 267 patients had open surgery for infrarenal AAA. Of these, 22 (8%) required temporary bilateral (15) or unilateral (7) renal artery clamping. 8 also had the left renal vein divided, three of which were re-anastomosed.

Results. Renal artery clamping and/or renal vein divisions did not affect the incidence of complications and long term renal failure.

Conclusions. Clamping of the renal arteries and/or renal vein division during AAA surgery does not in itself compromise short or long term renal function.

We reported our series of P/JRAA patients treated with OS to evaluate the impact of LRVD on **total** and **split** renal function.

Long-term fate of renal function after open surgery for juxtarenal and pararenal aortic aneurysm

Masayuki Sugimoto, MD, PhD, Noriko Takahashi, MD, PhD, Kiyoaki Niimi, MD, PhD, Akio Kodama, MD, PhD, Hiroshi Banno, MD, PhD, and Kimihiro Komori, MD, PhD, FACS *J Vasc Surg 2018; 67: 1042-50.*

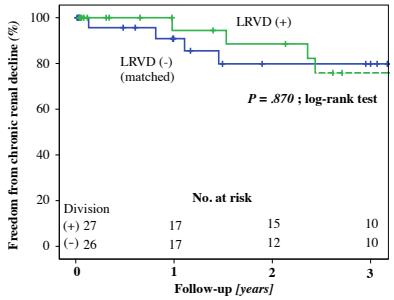
Conclusions: No significant impact of left renal vein division on CRD (chronic renal decline) was confirmed.

Effect of Intraoperative Division of the Left Renal Vein on the Fate of Renal Function and Left Renal Volume After Open Repair of Para- and Juxtarenal Aortic Aneurysm

Masayuki Sugimoto, MD, PhD; Noriko Takahashi, MD, PhD; Kiyoaki Niimi, MD, PhD; Akio Kodama, MD, PhD; Hiroshi Banno, MD, PhD; Kimihiro Kon *Circ J 2019; 83: 1844-50.*

Conclusions: LRVD had no significant effect on CRD or left renal volume relative to the right renal volume for up to 2 years.

Freedom from CRD in Matched cohorts



" The rates of freedom from CRD (chronic renal decline) were comparable between the LRVD group and the matched non-LRVD group "

Background

Left renal vein division (LRVD) is a maneuver performed during open surgical repair for abdominal aortic aneurysms.

However, the long-term effects of LRVD on renal remodeling are unknown.

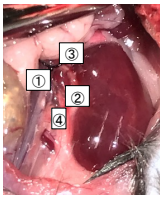
Purpose

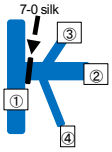
We examined whether the interrupting the venous return of the left renal vein cause renal congestion and fibrotic remodeling of the left kidney using a murine left renal vein ligation model.

Yoshino S . et al. Ann Vasc Surg 2023

Murine left renal vein ligation model

Ann Vasc Surg 2023; 96: 155–165



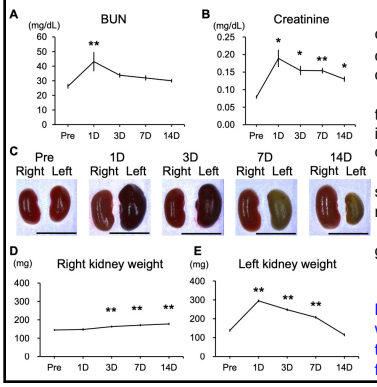


Ligation of LRV
LRV was ligated by 7-0 silk with preservation of at least one LRV branch vein.
1; vena cava, 2; LRV,
3; left adrenal vein,
4; left gonadal vein

We assessed the renal function and the pathohistological changes in the left kidneys.

We examined whether the interrupting the venous return of the left renal vein cause renal congestion and fibrotic remodeling of the left kidney.

Renal function and kidney weight in the murine LRVL model



BUN and Creatinine concentrations peaked 1 day after LRVL and then decreased.

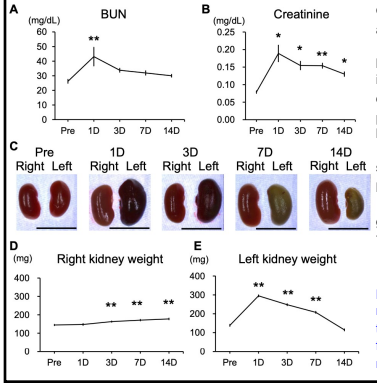
After LRVL, the weight of the left kidney significantly increased on postoperative days.

In contrast, there was no significant change in the right kidney weight on day 1.

The right kidney became gradually enlarged.

These results showed that LRVL might be associated with renal congestion and a temporary decrease in renal function in the murine model.

Renal function and kidney weight in the murine LRVL model



BUN and Creatinine concentrations peaked 1 day after LRVL and then decreased

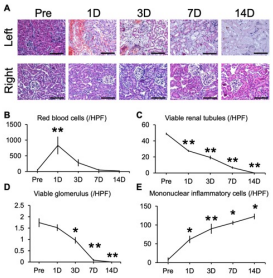
After LRVL, the weight of the left kidney significantly increased on postoperative days 1, 3, and 7 than the preoperative weights of the left kidney.

In contrast, there was no significant change in the right kidney weight on day 1.

The right kidney became gradually enlarged on days 3, 7, and 14.

These results showed that LRVL might be associated with renal congestion and a temporary decrease in renal function in the murine LRVL model.

LRVL may damage kidney cells associated with remodeling

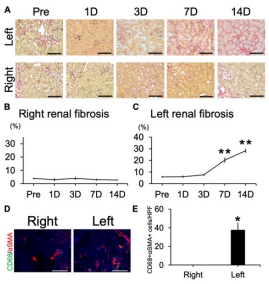


(Fig. A and E). The number of mononuclear cells progressively increased over the first 14 days after LRVL, indicating macrophage accumulation in the remodeled kidneys.

In summary, LRVL caused kidney congestion followed by macrophage accumulation and a reduction in the number of tubules and glomeruli.

LRVL may, therefore, be associated with kidney remodeling.

LRVL induced fibrosis only in the left kidney.



Myofibroblast-like macrophages were not confirmed in the right kidney.

(Fig. D and E) However, after LRVL, a significant accumulation of myofibroblast-like macrophages was observed in the left kidney.

In summary, LRVL causes renal fibrosis, which is associated with myofibroblast-like macrophage accumulation in the left kidney.

Patient characteristics with or without LRVD

- Clinica Data -

LRVD was performed on 26 patients among the 174 patients.

The patient characteristics and postoperative clinical outcomes are shown here.

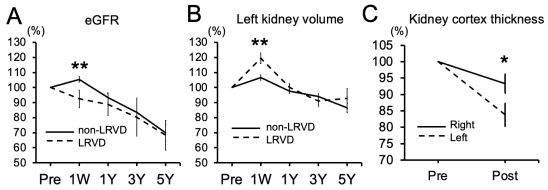
Variables	Non-LRVD $N = 148$	LRVD $N = 26$	P value
Age, years	72.1 ± 8.8	74.3 ± 9.0	0.22[a]
Male	127 (85.8)	22 (84.6)	0.77[b]
Hypertension	123 (83.1)	21 (80.8)	0.78[b]
Diabetes mellitus	17 (11.5)	3 (11.5)	1.00[b]
Dyslipidemia	54 (36.5)	9 (34.6)	1.00[b]
Chronic kidney disease	71 (48.0)	14 (53.9)	0.67[b]
Preoperative creatinine level, mg/dL	1.01 ± 0.40	1.03 ± 0.41	0.81[a]
Preoperative eGFR, mL/min/1.73 m2	61.0 ± 20.3	59.7 ± 20.3	0.75[a]
Aneurysm diameter, mm	53.3 ± 12.2	54.8 ± 9.3	0.55[a]
Juxta-/Pararenal aneurysm	14 (9.5)	15 (57.7)	<0.01[b]
Supra- or inter-renal artery clamp	17 (11.5)	17 (65.4)	<0.01[b]
Operation time, min	286 ± 106	380 ± 92	<0.01[a]
Blood loss, mL	1,692 ± 1,677	2,161 ± 1,263	0.18[a]
Renal ischemic time, min	56.9 ± 19.8	63.5 ± 37.9	0.45[a]
Reconstruction of renal artery	2 (1.4)	1 (3.9)	0.39[b]
Cold lactated ringer's solution	2 (1.4)	1 (3.9)	0.39[b]
AKI	3 (2.0)	10 (38.5)	<0.01[b]
Day of AKI occurrence			0.03[c]
1 POD	0 (0.0)	7 (70.0)	
2 POD	3 (100.0)	3 (30.0)	

The incidence of AKI was significantly higher in the LRVD group than in the non-LRVDgroup

The non-LRVD and LRVD groups significantly differed in operation times, the proportion of the patients who had suprarenal or inter-renal artery clamps.

Left renal vein division (LRVD) during open aortic repair (OAR) for AAA caused acute kidney injury with reduced kidney cortex thickness.

- Clinica Data -



In clinical practice, LRVD is associated with a higher incidence of postoperative AKI and temporary left kidney swelling. However, long-term kidney function was similar between the patients with and without LRVD. These findings support previous reports that have shown that LRVD can be safely performed. In addition, there is a reduction in renal cortical thickness in patients with LRVD.

Summary

Left renal vein division (LRVD) is a maneuver performed during open surgical repair for abdominal aortic aneurysms.

The interruption in the venous return of LRVD does not correlate with chronic renal failure.

However, both animal experiment and human data, venous return interruption of the left renal vein is associated with left kidney remodeling.

Therefore, we suggest careful follow-up of renal function after LRVD.