

ORIGINAL ARTICLES

Analysis and treatment of delayed hemorrhage after partial nephrectomy

Liming Zhao*, Zhizhong Liu, Changjiu Yue, Lizhong Han, Wenjun Cao

Department of Urinary Surgery, The Third Affiliated Hospital of Inner Mongolia Medical University, China

Received: January 20, 2018

Accepted: February 20, 2018

Online Published: March 10, 2018

DOI: 10.14725/dcc.v5n1p23

URL: <http://dx.doi.org/10.14725/dcc.v5n1p23>

Abstract

Objective: To explore the causes of delayed hemorrhage after partial nephrectomy and its prevention and treatment methods.

Methods: Clinical data for 64 cases of patients who received partial nephrectomy from August of 2010 to December of 2015 were retrospectively analyzed; whereas, 3 cases of patients (4.7%) had delayed hemorrhage, including 1 case of male patient and 2 cases of female patients. Then, compared them with patients with no hemorrhage to explore the risk factors for hemorrhage after partial nephrectomy.

Results: Three cases of patients showed a large volume of gross hematuria in 7-22 days (the average was 16.3 days) after partial nephrectomy, with blood pressure and hemoglobin (HGB) decreased. 2 cases of patients with hemorrhage were given blood transfusion and conservative treatment, and patients' conditions were improved obviously. The other patient was given super-selective renal artery embolization (SRAE), with renal arteriography indicating the presence of pseudoaneurysm. Hematuria disappeared after surgery. In comparison with the non-hemorrhage group, warm ischemia time was longer in the hemorrhage group, and the difference was of statistical significance ($p < .05$).

Conclusions: Hemorrhage occurred after partial nephrectomy is mostly delayed. Once the type of complications happens, it is required to provide a timely treatment. Super-selective renal artery embolization (SRAE) is a safe and effective treatment method for hemorrhage after partial nephrectomy.

Key Words: Partial nephrectomy, Postoperative hemorrhage, Risk factors

Compared with radical nephrectomy, nephron-sparing surgery (NSS) can effectively preserve as many nephrons as possible, and reduce the incidence of postoperative chronic kidney disease.^[1,2] With imaging examinations such as ultrasound, CT and MRI widely used clinically, the number of patients with NSS indications has also been increased. However, postoperative delayed hemorrhage is one of rare but severe complications. This complication often has sudden and severe onset. If it is not treated promptly, it can lead to hemorrhagic shock, even endanger patients' lives. Therefore, it is necessary to study the causes of delayed hemorrhage after NSS and its treatment strategies. 64 cases of patients were given NSS in our department from August of

2010 to December of 2015. There happened 3 cases of delayed hemorrhage in all, and the incidence was 4.7%. It was reported as follows.

1 Data and methods

1.1 Clinical data

This group consisted of 64 patients, including 41 males (64.1%) and 23 females (35.9%). The average age was 52 (20-84) years. There were 16 patients diagnosed with hamartoma (tumor enucleation was performed), 1 case of

*Correspondence: Liming Zhao; E-mail: 52320203@qq.com; Address: Department of Urinary Surgery, The Third Affiliated Hospital of Inner Mongolia Medical University, China.

patient was diagnosed with renal hemangioma, 1 case of patient was diagnosed with suppurative nephritis, and the rest were diagnosed with malignant kidney neoplasms. 44 cases of patients were given open partial nephrectomy (OPN, 68.8%), and 20 cases of patients were given laparoscopic partial nephrectomy (LPN, 31.2%).

In this group, there were 3 cases of postoperative hemorrhage patients, including 1 male and 2 females; aged from 55 to 63 years, with the mean age of 58.7 years. Two patients out of these three cases had left renal tumors, and the other patient had a right renal tumor; all of these tumors were all solitary exophyticly-grown tumors. The size of tumor was about 3.2-4.0 cm (average 3.7 cm). One of the female patients received right nephrectomy 5 years ago due to right renal carcinoma. The male patient had a medical history of hypertension.

1.2 Treatment methods

Two cases of patients received LPN and one patient underwent OPN. The operation was performed with standard partial nephrectomy via retroperitoneum (incisal margin > 5 mm). The renal artery was occluded for 18 to 40 minutes during the operation, with an average time of 32 minutes. The vascular segment and collective system breach in 1 case of patient were sutured with 3-0 absorbable sutures. The surface of renal parenchyma wound was sutured in a shape of “8” with 1-0 absorbable sutures, and the other 2 patients directly underwent a suture of renal parenchyma wound with 1-0 absorbable sutures, in a shape of “8”. The pathological returns for 3 patients were all clear cell carcinoma.

1.3 Statistical methods

SPSS16.0 software was applied to the statistical analysis, and the risk factors for hemorrhage after partial nephrectomy were analyzed by use of chi-square test and analysis of variance, the difference $p < .05$ was of statistical significance.

2 Results

Three cases of patients showed a large volume of dark red gross hematuria in 7-22 days (the average was 16.3 days) after partial nephrectomy, with blood pressure and hemoglobin (HGB) lower than those before surgery. Two cases of patients showed an estimated blood loss of 500-800 ml, with fluid infusion, anti-infection, hemostasis and other therapies given. Besides, patients were advised to guarantee strict bed rest as well as indwelling catheter drainage and other conservative treatment methods, with healthy conditions improved. Another patient showed a heavier hematuria and appeared pale, with increased heart rate, lower blood pressure, sweating, conscious body chills and other hemorrhagic shock expressions. The monitored HGB was 50.1 g/L, and the estimated blood loss was more than 1,000 ml. Under the support of blood transfusion, super-selective renal artery embolization was performed in the emergency treatment, with renal arteriography indicating the formation of pseudoaneurysm. Hematuria disappeared after operation.

Statistical analysis showed there was no statistically significant difference in age, gender, tumor size, location and surgical procedures between the non-hemorrhage group and the hemorrhage group ($p > .05$). However, warm ischemia time was longer in the hemorrhage group, and the difference was statistically significant ($p < .05$, see Table 1).

Table 1: Statistical data on patients with partial nephrectomy ($\bar{x} \pm s$)

Case Characteristics	Non-hemorrhage Group (n = 61)	Hemorrhage Group (n = 3)	p value
Age/years	54.0 ± 16.8	65.7 ± 7.5	.239
Gender (male/female, n)	40/21	1/2	.256
Tumor Location (L/R, n)	36/25	2/1	.792
Tumor Diameter/cm	3.5 ± 0.9	3.7 ± 0.9	.784
Surgical Procedure (LPN/OPN, n)	18/43	2/1	.228
Warm Ischemia Time/min	23.8 ± 6.4	32.0 ± 12.2	.043

3 Discussion

In recent years, with imaging techniques (such as ultrasound and CT) widely used in clinical work, the detection rate of asymptomatic renal tumors has been increased significantly. For benign renal tumors and small renal carcinoma (with diameter no more than 4 cm), partial nephrectomy is applied with a view to preserving nephrons. Studies have shown

that long-term recurrence-free survival and overall survival of partial nephrectomy performed to renal tumors smaller than 4 cm, are basically consistent with those of radical nephrectomy.^[3-5] However, in recent years, some scholars proposed that, tumors with the diameter ranging from 4 cm to 7 cm (including 7 cm) can also be considered as a selective indication for partial nephrectomy, but complications also appear accordingly.^[6,7] Postoperative hemorrhage and

urinary incontinence are the most common complications happened after partial nephrectomy. According to some literatures, the incidence of hemorrhage after partial nephrectomy ranges from 0% to 5.26%.^[8,9] The incidence in this group was 4.7%. The main clinical manifestations were persistent gross hematuria, lumbar distending pain/discomfort or a large volume of bloody fluid drained by perinephric catheter.

It is generally believed that the main causes of hemorrhage after partial nephrectomy are as follows: (1) Renal artery branches in the section are not ligatured or only ligatured partially, and arteriolar spasm occurs with no obvious bleeding during surgery but hemorrhage happens due to hemangiectasis after surgery; (2) When suturing the surface of kidney wound, the suture needle penetrates the artery in the renal parenchyma and leads to secondary bleeding.^[10] Some people thought that the dissolution of absorbable sutures may result in the rupture of the broken end of the wounded artery.^[11] Huang JW et al.^[12] reported that the tumor size, the relationship between the longitudinal position of tumor and the renal sinus and collective system were significantly associated with the incidence of the hemorrhage complication of OPN. Ye XJ et al.^[13] reported that warm ischemia time was longer in the hemorrhage group than that in the non-hemorrhage group, and the volume of blood loss was also larger in the hemorrhage group than that in the non-hemorrhage group. The difference was statistically significant. The results of this study have indicated that the causes of hemorrhage are related to renal warm ischemia time during surgery, and have no relationship with age, gender, tumor size, location and surgical procedures. Hemorrhage which happened to these 3 cases of patients mainly occurred in about 2 weeks after surgery. We analyzed that it was probably that the absorbable sutures were dissolved with blood clots organized and cleared in 2 weeks after surgery, so that the vascular segments of arteries and veins in the sutured wound were reopened, resulting in the complication of hemorrhage.

Hemorrhage after partial nephrectomy can be firstly treated in a conservative approach, such as strict bed rest, pain relief, intravenous fluid infusion. Blood transfusion and hemostatic drugs should be given if necessary. Most patients with hemorrhage will generally be better after the conservative treatment. If the bleeding is severe, it is required to perform an exploratory surgery. For refractory hemorrhage, the bleeding kidney often needs to be resected. With the advancement of interventional therapies, super-selective renal artery embolization has begun to be used clinically as a new method. This method can accurately diagnose renal artery hemorrhage and achieve the aim for hemostasis

without harming other nephrons. It is a safe and effective method, which has become the primary choice for the treatment of acute renal hemorrhage.^[14,15] After analysis of 3 patients in this group, it was found that, 2 cases of patients underwent LPN, 1-0 absorbable sutures were used to suture the wound in a shape of "8" by directly penetrating the renal parenchyma. Renal artery or vein branches in the section were probably not ligatured or only ligatured partially, resulting in postoperative bleeding. By means of conservative treatment, hematuria symptoms were relieved. Besides, no hematuria occurred within 1 year after the conservative treatment. As to the other case of patient, the tumor was located in a deeper position longitudinally. The vascular segment and collective system breach were sutured with 3-0 absorbable sutures. The renal parenchymal wound was sutured with 1-0 absorbable sutures in a shape of "8". Conservative treatment was applied to the postoperative hemorrhage, but hematuria was progressively worsened. Later, renal artery angiography was performed under the support of blood transfusion, indicating the formation of pseudoaneurysm. Super-selective renal artery embolization was performed in the emergency treatment, and hematuria disappeared after surgery. Hematuria did not occur again within 1 year of follow-up, and renal function was in a good condition.

In accordance with recent domestic and foreign literatures, we speculate that the causes of hemorrhage after partial nephrectomy may be related to the size of renal tumor, the relationship between the longitudinal position of tumor and the renal sinus and collective system, warm ischemia time, and inaccurate hemostasis of small arteriovenous branches in the wound during surgery. The statistical results of this study indicated that the causes of hemorrhage were only related to intraoperative warm ischemia time of the kidney. This may be due to the less number of surgical samples. Besides, the size of tumors mentioned in this group was mostly controlled at no more than 4 cm, resulting in a fact that the difference was of no statistical significance. With the increase in the number of large samples, the causes of hemorrhage after partial nephrectomy will be further verified definitely. In conclusion, delayed hemorrhage after partial nephrectomy is a serious postoperative complication, which can even endanger patients' lives. It is required to operate carefully in the first surgery to avoid it as far as possible. The occurrence of such complication requires prompt and active treatment. Percutaneous selective renal artery embolization is an effective treatment method.

Conflicts of Interest Disclosure

The authors have no conflicts of interest related to this article.

References

- [1] Scosyrev E, Messing E, Campbell S. Radical versus partial nephrectomy for a small renal mass: does saving nephrons save lives? *Expert Rev Anticancer Ther.* 2013; 13(12): 1349-1351. PMID: 24215129. <https://doi.org/10.1586/14737140.2013.856274>
- [2] Arnold ML, Thiel DD, Diehl N, et al. Comparison of baseline quality of life measures between renal cell carcinoma patients undergoing partial versus radical nephrectomy. *BMC Urol.* 2013; 13: 52. PMID: 24148752. <https://doi.org/10.1186/1471-2490-13-52>
- [3] Ficarra V, Rossanese M, Gnech M, et al. Outcomes and limitations of laparoscopic and robotic partial nephrectomy. *Curr Opin Urol.* 2014; 24(5): 441-447. PMID: 25022492. <https://doi.org/10.1097/MOU.0000000000000095>
- [4] Lane BR, Gill IS. 7-year ontological outcomes after laparoscopic and open partial nephrectomy. *J Urol.* 2010; 183(2): 473-479. PMID: 20006866. <https://doi.org/10.1016/j.juro.2009.10.023>
- [5] Shao PF, Yin CJ, Meng XX, et al. Retroperitoneal laparoscopic partial nephrectomy for the treatment of renal tumor. *Chinese Journal of Urology.* 2010; 31(10): 658-661.
- [6] Wheat JC, Robert WW, Hollenbeck BK, et al. Complications of laparoscopic partial nephrectomy. *Urol Oncol.* 2013; 31(1): 57-62. PMID: 21719322. <https://doi.org/10.1016/j.urolonc.2010.11.003>
- [7] Nadu A, Kleinmann N, Laufer M, et al. Laparoscopic partial nephrectomy for central tumors: analysis of perioperative outcomes and complications. *J Urol.* 2009; 181(1): 42-47; discussion 47. PMID: 19012908. <https://doi.org/10.1016/j.juro.2008.09.014>
- [8] Jung S, Min GE, Chung BI, et al. Risk factors for postoperative hemorrhage after partial nephrectomy. *Korean J Urol.* 2014; 55(1): 17-22. PMID: 24466392. <https://doi.org/10.4111/kju.2014.55.1.17>
- [9] Richstone L, Montag S, Ost MC, et al. Predictors of hemorrhage after laparoscopic partial nephrectomy. *Urology.* 2011; 77(1): 88-91. PMID: 21195825. <https://doi.org/10.1016/j.urology.2008.05.022>
- [10] Singh D, Gill IS. Renal artery pseudoaneurysm following laparoscopic partial nephrectomy. *J Urol.* 2005; 174(6): 2256-2259. PMID: 16280793. <https://doi.org/10.1097/01.ju.0000181827.49239.8e>
- [11] Uberoi J, Badwan KH, Wang DS. Renal-artery pseudoaneurysm after laparoscopic partial nephrectomy. *J Endourol.* 2007; 21(3): 330-333. PMID: 17444781. <https://doi.org/10.1089/end.2006.0260>
- [12] Huang JW, Kong W, Chen YH, et al. Risk factors and clinical management of hemorrhage after open partial nephrectomy. *Chinese Journal of Urology.* 2013; 34(9): 649-652.
- [13] Ye XJ, Zhang LJ, Liu SJ, et al. Analysis and management of early hemorrhage after laparoscopic partial nephrectomy. *Chinese Journal of Urology.* 2014; 35(10): 726-730.
- [14] Shapiro EY, Hakimi AA, Hyams ES, et al. Renal artery pseudoaneurysm following laparoscopic partial nephrectomy. *Urology.* 2009; 74(4): 819-823. PMID: 19647302. <https://doi.org/10.1016/j.urology.2009.03.056>
- [15] Jain V, Ganpule A, Vyas J, et al. Management of non-neoplastic renal hemorrhage by transarterial embolization. *Urology.* 2009; 74(3): 522-526. PMID: 19589577. <https://doi.org/10.1016/j.urology.2008.11.062>