Post Percutaneous Nephrolithotomy Massive Hematuria: Our Experience

N. Anil Kumar[1], S. Venkata Chaitanya[2], Satish Bezawada[3], S.R. Sree Gouri[4]

ABSTRACT

Introduction: Percutaneous nephrolithotomy (PCNL) is an integral component of the management of large-volume renal calculus disease with advantages of better stone clearance rates, cost effectiveness, and early convalescence. This study includes identifying risk factors and review of management of post PCNL massive hematuria in our institute.

Material and methods: Medical charts of all subjects who underwent PCNL from 2013 July to 2015 July were reviewed retrospectively and patients were divided in to massive hematuria and non massive hematuria groups after applying inclusion and exclusion criteria. Various patient related factors which include age, sex, presence of co-morbidities like diabetes, hypertension, presence of UTI, renal insufficiency, history of previous renal surgery, indication of PCNL, left vs right sided were compared between the two groups for their association with post PCNL massive hematuria and its management.

Results: Among the 242 patients included in study,13 patients required renal angiography for management of post PCNL hematuria.

Conclusion: Nowadays PCNL is the procedure of choice for removal of large renal calculi. It needs good surgical skills and an occasional vascular injury is probably unavoidable. Identification of risk factors influencing the incidence of severe vascular injuries is of the utmost importance for decreasing the rate of this serious and sometimes fatal complication.

Keywords: percutaneous nephrolithotomy, angiography, hematuria

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is an integral component of the management of large-volume renal calculus disease. It has the possible advantages of better stone clearance rates, cost effectiveness, and early convalescence compared with other modalities such as SWL and open stone surgery.[1] A high-flow arteriovenous network constituting 20% of the total cardiac output closely surrounds the collecting system. Access to the pelvicaliceal system and intrarenal manipulations may traumatize these vessels, resulting in significant bleeding.[2]

Renal hemorrhage is one of the most dangerous complications of PCNL.[3] Fortunately conservative measures are adequate to control bleeding in most cases. Angioembolization and further procedures are required in 1% of patients to control intractable bleeding.

Although the diagnosis of and treatment for post-PCNL renal bleeding was attempted by many[3-6] only a few groups have investigated risk factors and one of these studies failed to identify any risk factors.[3] Identification of the risk factors of post-PCNL severe hemorrhage is of paramount importance for their avoidance.[7] So we conducted this retrospective study to identify risk factors and to review management of post PCNL massive hematuria in our institute.

MATERIAL AND METHODS

Medical charts of all subjects who underwent PCNL from 2013 July to 2015 July in Sri Venkateshwara Institute of Medical Sciences were reviewed retrospectively after getting ethical clearance from institutional ethics committee.

Inclusion Criteria

a. All patients who underwent PCNL between July 2013 to July 2015.

Exclusion Criteria

a. Patients who underwent PCNL along with URSL on same side at same setting were excluded.
b. Patients who were referred with post PCNL massive hematuria from elsewhere from excluded from study.
c. Patients who underwent PCN placement for other indications.

After applying above inclusion and exclusion criteria, 242 patients undergoing PCNL patients undergoing PCNL between 2013 July to 2015 July were included in study.

Among the 242 patients, 13 patients had massive hematuria[8] (drop in Hb by 2gm/dl with 4 or more transfusions), and these patients constituted group A in our study. All patients in group A underwent renal angiography. Remaining 229 patients constituted group B and none of them underwent angiography.

Various patient related factors which include age, sex, presence of co-morbidities like diabetes, hypertension, presence of UTI, renal insufficiency, history of previous renal surgery, indication of PCNL, left vs right sided were compared between the two groups for their association with post PCNL massive hematuria.

Postoperatively, the time of presentation of hematuria, mode of management, mortality and morbidity (in terms of complications-if any, average hospital stay) were reviewed for all group A patients and compared with group B patients.

[1]Associate Professor, [2]Post Graduate, [3]Post Graduate, Department of Urology, [4]Assistant Professor, Department of Obstetrics and Gynaecology, SPMC(W) - Sri Venkateswara Institute of Medical Sciences, Tirupati, Andhra Pradesh, India

Corresponding author: Dr. Nallabothula Anil Kumar, Associate Professor, Department of Urology, SVIMS, D.No.5/5/346, 1st Floor 2nd house, Near Sneha Hospital, Sarojini Devi Layout, Tirupati, Andhra Pradesh State, India.

How to cite this article: N. Anil Kumar, S. Venkata Chaitanya, Satish Bezawada, S.R. Sree Gouri. Post percutaneous nephrolithotomy massive hematuria: our experience. International Journal of Contemporary Medical Research 2016;3(5):1499-1502.

STATISTICAL ANALYSIS

These patients data was coded into a Microsoft Excel (Redmond, WA) spreadsheet. Chi Square test is applied to test significance of association (p value < 0.05 – significant association) between various risk factors and massive hematuria.

RESULTS

Among the 242 patients who underwent PCNL in our institute between2013 July to 2015 July, 13 patients had massive post PCNL hematuria and required renal angiography for management of post PCNL hematuria while none of 229 patients had massive hematuria that needed renal angiography.

The age distribution showed 46% of patients in group A falling in age group of 40 – 60 years while 68 % of patients in group B were in age group of 30 – 50 years. Increasing age did not have significant correlation with post PCNL massive hematuria (p value – 0.2601).

The M:F ratio in group A was 1.6: 1and in group B was 0.8:1 and did not have significant association with post PCNL massive hematuria (p value – 0.2567).

Nine (69.2%) out of 13 patients in group had preoperative positive urine culture while 70 (30.56%) of 229 in group had preoperative positive urine culture. Presence of preoperative UTI showed significant association with post PCNL hematuria (p value – 0.0038).

Diabetes and hypertension were more prevalent in group A than group B (61.54% vs 26.63%, 69.23% vs 42.79%) while renal failure was more prevalent in group B (15.38% vs 20.08%). Of the three only diabetes showed significant association with Post PCNL massive hematuria (p value < 0.05).

Around 53.8% of patients did not have previous renal surgery in group A while 77.3% of patients group did not have a previous renal surgery. Previous renal surgery was not a significant risk factor in our study (p value - > 0.05).

Increased stone burden was a significant in our study with 46% of patients with staghorn calculi in group A compared to 11% in group B and 31% patients with multiple renal calculi compared to 26% in group B. (p value – 0.00425).

Side of puncture was comparable in both groups with about 46% of punctures being on left side while 53% on right side in both groups.

Of all the above preoperative factors compared only 3 factors showed a significant association with massive post PCNL hematuria viz. preoperative positive urine culture, presence of diabetes, and stone burden. (Table 1)

Among the 13 patients in Group A except for one presented with hematuria after 48 hours of procedure, 6 patients presented between 2 to 14 days while another 6 patients presented 14 days of procedure with hematuria.

There was no mortality in either groups. Morbidity of group A was more than group B in terms of mean drop of hemoglobin (4.5 vs 1.7 gm/dl), mean number of blood transfusions (4.6 vs1.8), hospital stay (13.7 days vs 4.5 days) and with greater incidence of postoperative complications (30% vs 11%) (Table 2).

Of the 13 patients in whom renal angiography was done, AV fistula was seen in 7 cases, pseudoaneurysm in 4 cases while both were seen in 2 patients.(Table 3). Angioembolization was successful in 10 of 13 patients (success rate of 77%) while 3 patients required flank exploration out of which partial nephrectomy was done in one patient while

Factors	Group A (n=13)	Group B (n=229)	p value
Mean age	47±15	44±12	0.2601
Sex ratio(M:F)	1.6:1	0.8:1	0.2567
Diabetes	8	61	0.0067
Hypertension	9	98	0.0619
UTI	9	70	0.0038
Renal insufficiency	2	46	0.6791
Previous surgery	6	52	0.0541
ESWL	2	30	0.8130
PCNL	3	16	0.6589
Open surgery	1	06	0.2884
Indications of PCNL*			0.00425
Staghorn calculi	5	25	0.00337
Multiple renal	5	60	0.33194
Ureteric	3	144	0.14255
Right vs Left	6/7	102/127	0.90942
*percutaneous nephrolithotomy			

Table-1: Preoperative variables

Morbidity	Group A	Group B
Mean drop in hemoglobin	4.5	1.7
Mean number of blood transfusions	4.6	1.8
Hospital stay	13.7 days	4.5 days
Post op complications	4(30%)	25(11%)
Mortality	---	---

Table-2: Postoperative morbidity and mortality

Study	AV fistula	Pseudo aneurysm	AVF*+PA**	Vessel laceration
Haung et al	50 %(6)	25%(3)	17%(2)	8%(1)
Richstone et al[17]	25%(14)	53% (30)	17% (10)	5%(3)
Zeng G et al[18]	21%(25)	54%(63)	21%(25)	4%(4)
Kessaris et al[3]	46.7%(7)	26.7%(4)	13.3%(2)	13.3%(2)
Martin et al[5]	37.5%(3)	50%(4)	12.5%(1)	----
Srivastava et al[6]	36.4%(8)	59.1%(13)	18.2%(4)	4.5%(1)
El-Nahas et al[7]	51.3%(20)	23.1%(9)	20.5%(8)	5.1%(2)
Jain et al[19]	43.9%	41.5%	12.5%(1)	---
Our study	54%(7)	15%(4)	31%(2)	----
*arteriovenous fistula, ** pseudo aneurysm				

Table-3: Angiography findings

nephrectomy was done in 2 patients. (Table 4)

DISCUSSION

Blood loss is one of the common complications of percutaneous nephrolithotomy with 1% to 11% requiring a blood transfusion.[8] Bleeding may result from traumatized renal parenchyma or injury to the perinephric vessels.[9] Massive bleeding can occur during needle puncture, tract dilatation, intraoperative instrument manipulation, or in the postoperative period.[3] Renal vessel damage with subsequent formation of arteriovenous fistulas or pseudoaneurysms is a well-known source of bleeding after kidney operations.

Arteriovenous fistulas and pseudoaneurysms of the renal arteries are formed by a high-pressure leak from a lacerated artery. The leak is transmitted through the tract into a lower resistance system, such as a vein or a connective tissue space.[10] There have been reports of bleeding attributable to arteriovenous fistulas or pseudoaneurysms as late as 13 weeks after a percutaneous nephrolithotomy.[11] In our study, 43% (6/12) of massive bleeding occurred in the early postoperative period (2 to 14 days after PCNL), and arteriovenous fistula formation as a late complication 40 days after PCNL was noted in 1 patient.

The first step in managing excessive blood loss is to monitor the vital signs of a patient. If nephrostomy tube is present, it is clamped for 4-8 hours, and an external compression dressing is applied.[8] A larger nephrostomy tube will tamponade the tract better. If the bleeding from the nephrostomy tube continues or gross hematuria with acute urine retention occurs, a blood transfusion plus fluid resuscitation and Foley catheterization with urinary bladder irrigation should be administered.[8] Hydration and intravenous administration of mannitol in hemodynamically stable patients can lead to rapid forced diuresis and swelling of the kidney within the capsule, which may enhance tract tamponade.[20]

In case of failure of these maneuvers, further evaluation with diagnostic imaging tools like color duplex sonography/ CT/ MR angiography or renal angiography is recommended. We generally do a renal angiography when these maneuvers fail and/or there is massive hematuria (drop in Hb by 2gm/dl with 4 or more transfusions). Vascular lesions can be treated with angiographic embolization at the same setting.

Angiography in our series revealed AV fistula in 7 cases, psuedoaneurysm in 4 cases and both in 2 cases. The incidence of AV fistulas and psuedoaneurysm in patients with post PCNL hematuria differed in various studies(Table 3).

Hyperselective embolization in our series was effective in 10 of 13 cases, (success rate- 77%) which is comparable with reported success rate worldwide ranges from 72 – 95%.[3-8] Embolization compromises blood flow to a portion of the kidney because of embolic occlusion of the intrarenal arterial branches. Partial renal ischemia and subsequent renal infarction are disadvantages of embolization which are minimized by super selective embolization. In our series embolization was not feasible due to technical difficulties in 3 cases, all of which were successfully managed by partial nephrectomy in 2 cases and total nephrectomy in one case.

Minimizing the number of needle punctures and selecting the correct puncture site are important in preventing excessive blood loss and a thorough understanding of renal vascular anatomy is essential for determining a correct puncture site.

Angioembolization	10
Partial nephrectomy	1
Nephrectomy	2

Table-4: Mode of management of hematuria in Group A patients (n=13).

Various risk factors were identified in various studies. In our study increased stone burden (p value - 0.00425),presence of diabetes (p value -0.0067),urinary tract infection (p value - 0.0038) are the risk factors for massive post PCNL hematuria that attained significant p value. Other patient-related factors, age, sex, hypertension and side of puncture did not show significant association.

Bleeding complications have been suggested to be greater in patients with renal insufficiency (creatinine 1.5 mg/dL) or hypertension. We did not find any increase in bleeding in either of these conditions. Diabetic patients are prone to increased blood loss due to associated arteriosclerosis with thickened basement membranes may make such patients more prone to bleeding after the initial trauma of tract formation.[2]

Stone burden was a significant risk factor in our study (p value - 0.00425).The incidence of massive hematuria post PCNL was more in patients with staghorn calculi (p value – 0.003) than renal or ureteric calculi. In Srivastava et al[6] increased stone size was the only risk factor identified for vascular complications during PCNL**.** Kukreja et al[12] reported the same and suggested that staging the procedure for removal of large calculi may offset the correlation with blood loss.

In our study preoperative positive urine culture is also identified as risk factor for massive hematuria post PCNL. The presence of an underlying infection may delay the formation of firm blood clots at the vascular puncture site. Kidneys that have had retroperitoneal inflammation from renal infection and are fixed in the retro peritoneum are especially at risk of parenchymal trauma during percutaneous intrarenal surgery. Similar results were also reported by Wen Haung et al[8] in 2003.

The role of prior intervention (open operation or PCNL) as a risk factor for increased blood loss during PCNL has been controversial. Netto and associates[15] identified prior surgery as a risk factor for increased bleeding. Stoller and colleagues[16] in their retrospective analysis, did not find any significant difference in blood loss in patients with and without a history of SWL or open surgery. Kukrejaet al[12] in contrary found a significant decrease in blood loss in patients with a history of PCNL or open surgery and attributed it to reduced renal cortical thickness. In our study we did not find any relation between previous surgery and bleeding.

CONCLUSION

The PCNL is the procedure of choice for removal of large renal calculi. Despite surgical skills, an occasional vascular injury is probably unavoidable. Identification of risk factors influencing the incidence of severe vascular injuries is of the utmost importance for decreasing the rate of this serious and

sometimes fatal complication.

In the current study we addressed this issue and identified diabetes, increased stone burden and presence of preoperative positive urine culture as three risk factors for massive post PCNL hematuria.

From our experience, major bleeding due to vascular injuries could be managed nonoperatively using hyperselective embolization. The high success rate of embolization (77%), the low level of complications, and certainty of the result in case of no technical problems seem overwhelming reasons for our choice. Failure of embolization should be treated by open surgery.

REFERENCES

1. Segura JW, Preminger GM, Assimos DG, et al Nephrolithiasis Clinical Guidelines Panel Summary Report on the Management of StaghornCalculi. J Urol. 1994;151:1648-51.
2. Pardalidis NP, Smith AD. Complications of percutaneous renal procedures. In: Controversies in Endourology. Philadelphia: WB Saunders,1995, p 179.
3. Kessaris DN, Bellman GC, Pardalidis NP, Smith AD. Management of hemorrhage after percutaneous renal surgery. J Urol. 1995;153:604-606.
4. Gupta M, Bellman GC and Smith AD: Massive hemorrhage from renal vein injury during percutaneous renal surgery: endourological management. J Urol. 1997;157:795-800.
5. Martin X, Murat FJ, Feitosa LC, Rouviere O, Lyonnet D, Gelet A et al: Severe bleeding after nephrolithotomy: results of hyperselective embolization. EurUrol. 2000; 37:136-139.
6. Srivastava A, Singh KJ, Suri A, Dubey D, Kumar A, Kapoor R et al: Vascular complications after Percutaneous nephrolithotomy: are there any predictive factors? Urology. 2005;66:38-40.
7. El-Nahas AR, Shokeir AA, El-Assmy AM, et al: Post-percutaneous nephrolithotomy extensive hemorrhage: a study of risk factors. J Urol. 2007;177:576–579.
8. Huang WH, Jiann BP, et al: Risk Factors of Massive Bleeding After Percutaneous Nephrolithotomy and its Management. JTUA 2003; 14:65-71.
9. Motola JA, Smith AD. Percutaneous techniques. In:High tech urology: technical innovations and their clinical applications. Edited by J.A. Smith, Jr. Philadelphia: W.B. Saunders Co 1992;ch. 9:208-23.
10. Cope C, Zeit RM. Pseudoaneurysms after nephrostomy. Am J Roentgen. 1982;139:255-61.
11. Gavant ML, Gold RE, Church JC. Delayed rupture of renal pseudoaneurysm: complication of percutaneous nephrostomy. AJR. 1982;138:948-9.
12. Kukreja R, Desai M et al. Factors affecting bloodloss during percutaneousnephrolithotomy: prospective study. J Endourol. 2004;18:715-22.
13. Wang Y, Jiang F et al. Post-Percutaneous Nephrolithotomy Septic Shock and Severe Hemorrhage: A Study of Risk Factors.Urol Int. 2012;88:307–310.
14. Ganpule,Arvind P et al. Postpercutaneousnephrolithotmy bleeding: aetiology and management. Current opinion in urology. 2014; 24:189–94.
15. Netto R, Lemos GC, Palma PC, Fiuza JL. Staghorn calculi: Percutaneous versus anatrophic nephrolithotomy. Eur Urol. 1988;15:9.
16. Stoller ML, Wolf JS, St Lezin MA. Estimated blood loss and transfusion rates associated with percutaneous nephrolithotomy. J Urol. 1994;152:1977.
17. Richstone L, Reggio E et al. Hemorrhage Following Percutaneous Renal Surgery: Characterization of Angiographic Findings.J Endourol. 2008;22:1129-35.
18. Zeng G, Zhao Z et al. Failure of Initial Renal Arterial Embolization for Severe Post-Percutaneous Nephrolithotomy Hemorrhage: A Multicenter Study of Risk Factors. J Urol. 2013;190:2133-38.
19. Jain V, Ganpule AP, Vyas J, et al. Management of nonneoplastic renal hemorrhage by transarterial embolization. Urology. 2009;74:522–526.
20. Huber J, Pahernik S and Hallscheidt P: Selective transarterial embolization for posttraumatic renal hemorrhage: a second try is worthwhile. J Urol. 2011; 185:1751.

Source of Support: Nil; **Conflict of Interest:** None

Submitted: 29-03-2016; **Published online**: 28-04-2016