OPEN ACCESS

Research Article

Focal neuropathies following percutaneous nephrolithotomy (PCNL) – preliminary study

Fokale Neuropathien nach perkutaner Nephrolithotomie (PCNL)

Hamidreza Nasseh[1]
Farshid Pourreza[1]
Alia Saberi[2]
Ehsan Kazemnejad[1]
Behnam Behmardi Kalantari[1]
Siavash Falahatkar[1]

1 Urology Research Center, School of Medicine, Guilan University of Medical Sciences, Iran

2 Neurology Department, School of Medicine, Guilan University of Medical Sciences, Iran

Abstract

Introduction: Postoperative neurological complications in pelvic and renal surgery are a well-known clinical problem and their morbidities are important. We designed this study to determine prevalence and risk factors of such complications after percutaneous nephrolithotomy (PCNL) surgery.
Material and methods: A cross-sectional study was performed during February and July 2011 on 68 PCNL cases. Demographic data and surgery reports were gathered and comprehensive neurological physical examination carried out before and after surgery. Then, data was analyzed using software SPSS 18.
Results: The ultimate sample included 30 (46.2%) male and 35 (53.8%) female patients with a mean age of 47.9 ± 11.47 years. In intercostal and lumbosacral plexus area, sensory neurological complications occurred in 8 patients (12.31%), 4 men and 4 women. The most common involved dermatomes and nerves were T12 (8 cases). There was a significant correlation between prolonged duration of surgery and prevalence of sensory complications ($p<0.010$). The highest hemoglobin value drop after surgery occurred in patients with neurological complications ($p<0.001$). There were no correlations between age, tracts used, diabetes mellitus, BMI, hypertension, positioning of patients and side of surgery with incidence of sensory neurological complications. No motor neurological complications occurred.
Conclusion: Prolonged duration of PCNL and increased value of hemoglobin drop may lead to increased risk of neuropathy. Larger prospective studies with retroperitoneal imagings and patients' follow up is suggested for better understanding of this complication.

Keywords: percutaneous nephrollithotomy, neuropathy, complication

Zusammenfassung

Einleitung: Postoperative neurologische Komplikationen bei operativem Eingriff an Becken und Niere sind ein bekanntes klinisches Problem und deren Krankheitsverläufe sind wichtig. Wir planten diese Studie, um die Prävalenz und die Risikofaktoren derartiger Komplikationen nach perkutaner Nephrolithotomie (PCNL) zu erfassen.
Material und Methoden: Von Februar bis Juli 2011 wurde eine Querschnittstudie an 68 PCNL-Fällen durchgeführt. Die demographischen Daten und die Operationsberichte wurden ausgewertet und umfassende neurologische und körperliche Untersuchungen wurden vor und nach dem chirurgischen Eingriff vorgenommen. Die Daten wurden mit der Software SPSS 18 analysiert.
Ergebnisse: In die Studie einbezogen wurden 30 männliche (46,2%) und 35 (53,8%) weibliche Patienten mit einem mittleren Alter von 47,9 ± 11,47 Jahren. Bei 8 Patienten (12,31%), bei 4 Männern und 4 Frauen, wurden im Bereich des interkostalen und lumbosakralen Plexus sensorische neurologische Komplikationen gefunden. Die am häufigsten betroffenen Dermatome und Nerven waren im Bereich T 12 (8 Fälle). Es gab eine signifikante Korrelation zwischen der Dauer des chirurgischen

Eingriffes und dem Vorkommen von sensorischen Komplikationen (p<0,010). Der höchste Abfall der Hämoglobinkonzentration nach dem chirurgischen Eingriff trat bei Patienten mit neurologischen Komplikationen auf (p<0,001). Es gab keine Korrelation zwischen Alter, gewähltem Zugang, Diabetes mellitus, BMI, Bluthochdruck, Lagerung der Patienten und Ort des chirurgischen Eingriffs und den beobachteten sensorischen neurologischen Komplikationen.
Schlussfolgerung: Verlängerte Dauer der PCNL und erhöhter Abfall der Hämoglobinkonzentration können zu einem erhöhten Risiko für einer Neuropathie führen. Größere prospektive Studien mit retroperitonealen bildgebenden Untersuchungen und mit Verlaufskontrollen bei den Patienten werden vorgeschlagen, um diese Komplikation besser zu verstehen.

Schlüsselwörter: perkutane Nephrolithotomie, Komplikationen, Neuropathie

Introduction

In urology departments approximately one third of the operations are performed for urinary stone management, most of them using less invasive procedures [1]. Percutaneous nephrolithotomy (PCNL) is one of such procedures and is more common in academic hospitals [2], [3]. Over the last decade, high successrate and low morbidity rate of PCNL developed its usage [1], [2]. Although complications after PCNL are common, 80% are often minor and 20% are major including septicemia, bleeding, and damage to lung and colon [4], [5]. Little is depicted on neurological complications following PCNL in the literature [6], [7], [8], [9], [10].
In our center, we encountered complaints of ipsilateral abdominal wall and upper thigh numbness after PCNL. Regarding to the wide application of this procedure, investigation on its less-known complications seems fruitful. Thus, this study was designed to determine the frequency and risk factors of neurological defects following PCNL.

Materials and method

In a cross-sectional study data of PCNL cases from February 2011 to July 2011were included. Age, gender, side, BMI and medical background of patients were registered. Comprehensive neurological physical examination considering neural dermatomes was carried out before the surgical operation on both sides by a single neurologist. The patients with unilateral neuropathy and asymmetrical pre-operation neurological examination were excluded from the study. The position of the patient during operation, operation time, number of the tracts used and pre-operation and first day post-operation hemoglobin were registered, too. On 10th day after operation neurologic physical examination was repeated by the same neurologist and the type of nervous engagement and the name of the nerve engaged were described. All patients underwent general anesthesia and 2 surgeons carried out operations (one prone and one supine positions). Ureter stent was inserted at the beginning of the procedure in all patients and remained during hospitalization. Semirigid plastic dilation technique was used in all cases. In prone cases the nephrostomy tube was inserted at the end of procedure, but in supine was not due to surgeon preference. Rigid nephroscope and pneumatic lithoclast were used during procedures. None supracostal tract access was used and none of the patients was in uremia status. Then, data were analyzed by Chi-square, Fisher's Exact and Independent T Test using software SPSS18. Urology research center ethical commitee approved the study.

Results

Out of 68 patients who underwent PCNL from February 2011 to July 2011, three were excluded because of asymmetric neurologic examination before operation. From the rest (30 males and 35 females) with a mean age of 47.9 ±11.47, eight patients (4 male and 4 female) had abnormal neurologic examination on 10th day after operation (Table 1). According to the table, the most prevalent engaged dermatome were sub-abdominal dermatomes specially T12. One patient suffered paresthesia and dysesthesia of T10-11-12 dermatomes and ilioinguinal nerve, sensory branch of femoral nerve and lateral cutaneous nerve of thigh. Heterogeneous clinical presentations were seen. The sensory disorders observed in patients consisted of hypoesthesia, paresthesia, dysesthesia and/or a combination of several disorders as given in details in Table 2. No other nervous system lesions (including obturator, genitofemoral nerves and brachial plexus), motor lesion, paraplegia or visual defects were observed. According to Table 3, only operation time and hemoglobin drop was statistically different between the two groups. Neurologic lesions had occurred among the patients having had prolonged surgical operations.
Mean hemoglobin rate among the patients suffering neurological problems before and after PCNL were 14.04 ± 1.28 and 10.18 ± 1.83 mg/dl respectively (versus the asymptomatic group of patients having the rate of 13.21 ± 1.55 and 11.34 ± 2.21 before and after PCNL). No

Table 1: Results of postoperation neurologic examination and nerve involvement

Involvement	1	2	3	4	5	6	7	8
T10	×	×	×			×		
T11	×	×	×	×	×	×		×
T12	×	×	×	×	×	×	×	×
Ilioinguinal nerve (L1)					×	×	×	
Iliohypogastric nerve (L1)					×		×	×
Lateral cutaneous nerve of thigh (L2, 3)						×		
Sensory branch of femoral (L2–4)						×		

Table 2: Kind of postoperation sensory disorders

Involvement	Hypo-esthesia	Paresthesia	Dysesthesia	Paresthesia dysesthesia	Hypoesthesia dysesthesia	Hypoesthesia paresthesia
T10	1	2	0	1	0	0
T11	1	3	1	1	0	1
T12	1	3	1	1	1	1
Ilioinguinal nerve (L1)	0	0	1	1	1	0
Iliohypogastric nerve (L1)	0	0	1	0	1	1
Lateral cutaneous nerve of thigh (L2, 3)	0	0	0	1	0	0
Sensory branch of femoral (L2–4)	0	0	0	1	0	0

Table 3: Comparison of neurologic symptomatic group with asymptomatic group

	symptomatic	asymptomatic	P value
Gender (male/female)	4/4	26/31	0.554
Age	48.10 ± 10.2	47.67 ± 12.74	0.668
Side (right/left)	2/6	24/32	0.288
BMI	26.9 ± 3.86	28.01 ± 4.22	0.161
Diabetes mellitus	1/8	8/57	0.90
Hypertension	1/8	6/57	0.66
Position (prone/supine)	5/3	29/28	0.408
Tract number	1.13 ± 0.354	1.09 ± 0.285	0.782
Operation time (min)	65 ± 24.35	47.95 ± 15.71	0.010
Hgb drop	3. 86 ± 1.81	1.87 ± 1.48	0.001

significant correlation between the emergence of sensory neurologic problems and other factors were observed.

Discussion

In the literature, postsurgical neuropathies have been reported after various operations such as aortic surgery, appendectomy, inguinal hernia repairment and radical perineal prostectomy [11], [12], [13]. Thigh numbness and femoral nerve damage after kidney transplantation [14] and lower limbs neuropathies after gynecological surgeries [15] have been shown too.

Heterogeneous causes have been assumed for these disorders including ischemia, hematoma pressure, positioning, diabetes, patient's thinness, duration of operation and application of retractor [11], [14], [15], [16]. These neuropathies may lead to pain, morbidity, reduction of the quality of life, economical problems and legal complaints [11], [16], [17]. Flank incision is accompanied by complications such as pain, intercostals neuropathy, and incisional hernia in 8% to 50% of cases [18], [19], [20], and even testicular pain [20] has been reported.

Therefore, small and smaller incisions replace large ones [21]. One of such procedures is PCNL which makes access to kidney through dilatation. Although reports mentioning femoral neuropathy [6], lumbar hernia [22], blindness, brain emboli and neurological defects [10] after this procedures exist.

At our institution cases were observed in which ipsilateral abdominal wall and upper thigh numbness, tenderness, and sometimes pain occurred after PCNL despite minimal invasive nature of the procedure. So we designed this study to determine prevalence and risk factors of neurological defects after PCNL.

Sensory neurological complications (touch and needle perception decrease) in intercostals and lumbosacral plexus area occurred in 8 patients (12.31%), in which gender distributed equally. The most common involved dermatomes and nerves were T12 (all involved cases). There was a significant correlation between prolonged duration of surgery and prevalence of sensory complications. The most hemoglobin value drop after surgery occurred in patients with neurological complications. No other nervous system lesions including motor lesion, paraplegia or visual defects were observed, so we can consider these sensory neuropathies as grade I of Clavien system [5].

Our study failed to reveal a meaningful correlation between patients' age, DM, hypertension, tracts used, positioning of patients and side of surgery with incidence of sensory neurological deficits.

Regarding the finding that the commonest nerve involved was T12, one justification is direct damage and surgical trauma. Abdominal wall and skin are innervated by 7–12 intercostal nerves. The effect of PCNL access on intercostals nerves and vessels have been studied and lateral access was found to produce the most damages [7]. Direct nervous plexus trauma in minimal invasive PCNL procedure may occur and direct lumbar plexus trauma has been reported in pelvic kidney PCNL [6].

Although retroperitoneal imaging was not done in our study, another justification for neuropathy following PCNL is retroperitoneal blood accumulation and pressure effect on the nerves. Perinephric hematoma following PCNL has been reported in 30% of cases [2], [23] and even may lead to kidney displacement [23]. The relation between retroperitoneal hematoma and femoral neuropathy has been shown previously [24], [25] and there are similar studies on lateral cutaneous nerve of thigh [14], [26]. The Hgb drop and duration of surgery which has been correlated to neuropathy following PCNL can be regarded as an indicator for surgical trauma and hematoma formation.

Urinoma formation and irrigation fluid accumulation have been reported in 2–7% of cases [2] and may have similar effect as hematoma.

Some specialists believe that inflammatory or autoimmune factors have some influence on postsurgical neuropathy and also lumbosacral damage following total hip arthroplasty and bilateral sciatic neuropathy following radical nephrectomy has been described [14]. Anesthesia and ischemia may play a role in postoperative neuropathies [13], [14], [16].

Although, positioning has been found to be a risk factor in postoperative neuropathies [17], prone or supine position was not different in our study (Table 3). We did not observe motor lesion in patients but it may be due to small sample size as a single center study. The time of onset and end of damages were not investigated which can be considered as another limitation of study. Lack of retroperitoneal imaging prevented us to assess hematoma and fluid pressure on nerves. We must consider this study as a preliminary one that should be pursued by larger multicenter analytic surveys. Our findings suggest that endourologists should avoid prolonged and kidney traumatizing PCNLs.

Conclusions

To our knowledge, this is the first evaluation of neurological defects after PCNL. Prolonged procedure duration and increased value of hemoglobin drop may lead to increased risk of neuropathy. Larger prospective analytic studies with retroperitoneal imaging and patients' longitudinal follow-up are suggested for better understanding of this complication.

Abbreviations

PCNL – percutaneous nephrolithotomy
SWL – shock wave lithotripsy
Hgb – hemoglobin
IC – intercostals
BMI – body mass index

Notes

Competing interests

The authors declare that they have no competing interests.

References

1. de la Rosette J, Assimos D, Desai M, Gutierrez J, Lingeman J, Scarpa R, Tefekli A; CROES PCNL Study Group. The Clinical Research Office of the Endourological Society Percutaneous Nephrolithotomy Global Study: indications, complications, and outcomes in 5803 patients. J Endourol. 2011 Jan;25(1):11-7.
2. Semins MJ, Bartik L, Chew BH, Hyams ES, Humphreys M, Miller NL, Shah O, Paterson RF, Matlaga BR. Multicenter analysis of postoperative CT findings after percutaneous nephrolithotomy: defining complication rates. Urology. 2011 Aug;78(2):291-4. DOI: 10.1016/j.urology.2010.11.008
3. Morris DS, Taub DA, Wei JT, Dunn RL, Wolf JS Jr, Hollenbeck BK. Regionalization of percutaneous nephrolithotomy: evidence for the increasing burden of care on tertiary centers. J Urol. 2006 Jul;176(1):242-6. DOI: 10.1016/S0022-5347(06)00512-X

4. Michel MS, Trojan L, Rassweiler JJ. Complications in percutaneous nephrolithotomy. Eur Urol. 2007 Apr;51(4):899-906. DOI: 10.1016/j.eururo.2006.10.020

5. Labate G, Modi P, Timoney A, Cormio L, Zhang X, Louie M, Grabe M, Rosette On Behalf Of The Croes Pcnl Study Group J. The percutaneous nephrolithotomy global study: classification of complications. J Endourol. 2011 Aug;25(8):1275-80. DOI: 10.1089/end.2011.0067

6. Monga M, Casta-eda-Zu-iga WR, Thomas R. Femoral neuropathy following percutaneous nephrolithotomy of a pelvic kidney. Urology. 1995 Jun;45(6):1059-61. DOI: 10.1016/S0090-4295(99)80133-2

7. McAllister M, Lim K, Torrey R, Chenoweth J, Barker B, Baldwin DD. Intercostal vessels and nerves are at risk for injury during supracostal percutaneous nephrostolithotomy. J Urol. 2011 Jan;185(1):329-34. DOI: 10.1016/j.juro.2010.09.007

8. Kachalia AG, Savant CS, Patil S, Gupta S, Kapadia FN. Cerebral and spinal air embolism following percutaneous nephrolithotomy. J Assoc Physicians India. 2011 Apr;59:254-6.

9. Droghetti L, Giganti M, Memmo A, Zatelli R. Air embolism: diagnosis with single-photon emission tomography and successful hyperbaric oxygen therapy. Br J Anaesth. 2002 Nov;89(5):775-8. DOI: 10.1093/bja/89.5.775

10. Agah M, Ghasemi M, Roodneshin F, Radpay B, Moradian S. Prone position in percutaneous nephrolithotomy and postoperative visual loss. Urol J. 2011 Summer;8(3):191-6.

11. Saidha S, Spillane J, Mullins G, McNamara B. Spectrum of peripheral neuropathies associated with surgical interventions; A neurophysiological assessment. J Brachial Plex Peripher Nerve Inj. 2010 Apr 19;5:9. DOI: 10.1186/1749-7221-5-9

12. Staff NP, Engelstad J, Klein CJ, Amrami KK, Spinner RJ, Dyck PJ, Warner MA, Warner ME, Dyck PJ. Post-surgical inflammatory neuropathy. Brain. 2010 Oct;133(10):2866-80. DOI: 10.1093/brain/awq252

13. Hall MC, Koch MO, Smith JA Jr. Femoral neuropathy complicating urologic abdominopelvic procedures. Urology. 1995 Jan;45(1):146-9. DOI: 10.1016/S0090-4295(95)97640-X

14. Nikoobakht M, Mahboobi A, Saraji A, Mehrsai A, Emamzadeh A, Mahmoudi MT, Pourmand G. Pelvic nerve neuropathy after kidney transplantation. Transplant Proc. 2007 May;39(4):1108-10. DOI: 10.1016/j.transproceed.2007.03.085

15. Warner MA, Warner DO, Harper CM, Schroeder DR, Maxson PM. Lower extremity neuropathies associated with lithotomy positions. Anesthesiology. 2000 Oct;93(4):938-42. DOI: 10.1097/00000542-200010000-00010

16. Akhavan A, Gainsburg DM, Stock JA. Complications associated with patient positioning in urologic surgery. Urology. 2010 Dec;76(6):1309-16. DOI: 10.1016/j.urology.2010.02.060

17. Cheney FW, Domino KB, Caplan RA, Posner KL. Nerve injury associated with anesthesia: a closed claims analysis. Anesthesiology. 1999 Apr;90(4):1062-9. DOI: 10.1097/00000542-199904000-00020

18. Hoffman RS, Smink DS, Noone RB, Noone RB Jr, Smink RD Jr. Surgical repair of the abdominal bulge: correction of a complication of the flank incision for retroperitoneal surgery. J Am Coll Surg. 2004 Nov;199(5):830-5. DOI: 10.1016/j.jamcollsurg.2004.07.009

19. Zieren J, Menenakos C, Taymoorian K, Müller JM. Flank hernia and bulging after open nephrectomy: mesh repair by flank or median approach? Report of a novel technique. Int Urol Nephrol. 2007;39(4):989-93. DOI: 10.1007/s11255-007-9186-x

20. Taghavi R. The complications and morbidity of flank incision for living renal donor. Transplant Proc. 2001 Aug;33(5):2638-9. DOI: 10.1016/S0041-1345(01)02124-8

21. Resnick MI. Flank incision. J Urol. 2004 Sep;172(3):823. DOI: 10.1097/01.ju.0000139457.83242.7f

22. Reggio E, Sette MJ, Lemos R, Timm O Jr, Junqueira RG. Lumbar hernia following percutaneous nephrolitotomy. Clinics (Sao Paulo). 2010;65(10):1061-2. DOI: 10.1590/S1807-59322010001000025

23. Chichakli R, Krause R, Voelzke B, Turk T. Incidence of perinephric hematoma after percutaneous nephrolithotomy. J Endourol. 2008 Jun;22(6):1227-32. DOI: 10.1089/end.2008.0002

24. Parmer SS, Carpenter JP, Fairman RM, Velazquez OC, Mitchell ME. Femoral neuropathy following retroperitoneal hemorrhage: case series and review of the literature. Ann Vasc Surg. 2006 Jul;20(4):536-40. DOI: 10.1007/s10016-006-9059-2

25. Nakao A, Sakagami K, Mitsuoka S, Uda M, Tanaka N. Retroperitoneal hematoma associated with femoral neuropathy: a complication under antiplatelets therapy. Acta Med Okayama. 2001 Dec;55(6):363-6.

26. Marban-Arcos SE, Flores-Terrazas JE, Cogordán-Coló J, et al. Meralgia paresthetica as a urological surgery complication: A case presentation and literature review. Rev Mex Urol. 2008;68(2).

Corresponding author:

Farshid Pourreza

Urology Research Center, School of Medicine, Guilan University of Medical Sciences, 41448 95596, Razi Hospital, Sardar Jangal Street, Rasht, Iran, Phone: 0098 131 5525259, fax: 0098 131 5525259

pourreza.farshid@yahoo.com

Please cite as

Nasseh H, Pourreza F, Saberi A, Kazemnejad E, Kalantari BB, Falahatkar S. Focal neuropathies following percutaneous nephrolithotomy (PCNL) – preliminary study. GMS Ger Med Sci. 2013;11:Doc07.

DOI: 10.3205/000175, URN: urn:nbn:de:0183-0001759

This article is freely available from

http://www.egms.de/en/journals/gms/2013-11/000175.shtml

Received: *2013-03-20*

Revised: *2013-04-21*

Published: *2013-06-13*