Percutaneous Nephrolithotomy for Kidney Stones in Patients with Hematological Malignancy

Hematolojik Kanseri olan Böbrek Taşlı Hastalarda Perkütan Nefrolitotomi

Percutaneous Nephrolithotomy in Hematological Malignancy

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Özet

Amaç: Hematolojik kanser (HK) öyküsü olan hastalarda böbrek taşı için yapılan perkütan nefrolitotomi (PNL) operasyonunun sonuçlarını incelemek. Gereç ve Yöntem: Merkezimizde, 2000-2013 yılları arasında böbrek taşı tedavisi için 1700 erişkin hasta PNL operasyonuna girmiştir. 4 hasta HK öyküsüne sahipti ve bunlar HK grubu olarak çalışmaya alındı (n=4). Operasyon öyküsü, HK veya herhangi bir komorbid hastalık öyküsü bulunmayan 10 ileri yaşlı hasta (>65 yaş) kontrol grubu olarak seçildi (n=10). Cerrahi parametreler, başarı oranları, ek tedavi gereksinimleri ve komplikasyonlar değerlendirildi. Bulgular: İstatistiksel analizler; taş büyüklüğü, operasyon süresi, floroskopi süresi, hastanede kalış süresi, ΔHb, kan transfüzyon oranları ve INR değerleri açısından HK ve kontrol grup arasında anlamlı bir fark göstermedi (p>0.05). İstatistiksel analizler; başarı oranları açısından HK ve kontrol grup arasında anlamlı bir fark göstermedi (p=0.470). İstatistiksel analizler; ek tedavi gereksinimleri açısından HK ve kontrol grup arasında anlamlı bir fark göstermedi (p=0.882). Her iki grupta da major perioperatif komplikasyon gözlenmedi. Tartışma: Hematolojik kanser öyküsü olan böbrek taşı hastalarının PNL ile tedavisi uygulanabilir, güvenli ve etkilidir. Bununla beraber, operayon öncesinde Hematoloji bölümü ile yakın kooperasyon gerekmektedir.

Anahtar Kelimeler

Perkütan Nefrolitotomi; Böbrek Taşları; Hematolojik Kanserler

Abstract

Aim: To define the alterations in the outcomes of percutaneous nephrolithotomy (PNL) operations for kidney stones in patients with history of hematological malignancy (HM). Material and Method: Between 2000 and 2013, 1700 adult patients underwent PNL for the treatment of kidney stones in our institution. Four of these patients had a history of HM and considered to be HM group (n=4). Ten elderly (>65 years) patients who had no history of operation, HM or any other co-morbide diseases were chosen as the control group (n=10). Surgical parameters, success rates, additional treatments and complications were evaluated. Results: Statistical analyses showed no significant differences between HM and control group according to stone area, operation time, fluoroscopy time, hospitalization time, ΔHb, blood transfusion rates and INR values (p>0.05). Statistical analyses revealed no significant differences between HM and control groups according to the success rates (p=0.470). Statistical analyses revealed no significant difference between groups for additional treatment requirements (p=0.882). No major perioperative complication was seen in both of the groups. Discussion: The treatment of kidney stone disease by PNL in patients with hematological malignancy is feasible, safe and effective. However, close cooperation with the Hematology Department before the operation is mandatory.

Keywords

Percutaneous Nephrolithotomy; Kidney Stones; Hematological Malignancy

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Introduction

Progress in the minimally invasive treatment of kidney stones has enabled urologists to successfully treat patients with co-morbid diseases such as diabetes mellitus, hypertension and obesity. Hematological malignancies (HM) are also serious co-morbid diseases that comprise a collection of heterogeneous conditions, all originating from cells of the bone marrow and the lymphatic system. HM represented three major groups; leukemias, lymphomas, and plasma cell neoplasms[1]. In the United States of America, HM represented nearly 106,200 new cases in 2003, it is considered as the second most common cause of cancer deaths, affected approximately 57,000 people in the same year [1]. The operative risk of patients with malignant hematological disorders is increased, as this may include coagulation defects, changes in blood viscosity, immune suppression and bone narrow insufficiency [2]. When surgically treating these patients, the surgeon must be concerned about postoperative infection, hemorrhage and leukaemic transformation. Surgical trauma, because of its immune-depressing effects, have the potential risk of increasing the hematological problems, leading to fatal or morbid complications [3]. The outcomes of percutaneous nephrolithotomy (PNL) procedures in this subset of patients have not been documented in the surgical literature yet.

In this study, we retrospectively analyzed the results of PNL operations in the treatment of kidney stones in patients with history of hematological malignancy. We also compared the surgical parameters and outcomes with a control group. The aim of the study was to define the alterations in the outcomes of PNL operations for kidney stones in patients with history of hematological malignancy.

Material and Method

Patients: Between 2000 and 2013, 1700 adult patients underwent PNL for the treatment of kidney stones in our institution. Four of these patients had a history of HM and considered to be HM group (n=4). In this group, 2 of the patients had Non-Hodgin's Lymphoma (NHL), one of them Hodgin's Lymphoma (HL) and one of them chronic myeloid leukemia (CML). Three of the patients in HM group were initially treated by chemotherapy regimens according to the protocols of Hematology Department in our institution and were considered to be at remission period. The other patient in HM group was diagnosed as NHL just before the PNL operation and decided to be treated six weeks after the operation by the Hematology Department since he was considered to be suitable for the operation according to the blood cell counts and had no risk of bleeding diathesis. Among 1700 patients, 10 elderly (>65 years) patients had no history of operation, HM or any other co-morbide diseases; thus, they were considered to be the control group (n=10). We preferred elderly patients in order to eliminate the age factor among groups, since the HM group was consist of patients older than 57 years. The kidney stones were diagnosed by intravenous pyelography (IVU) and/or computerized tomography (CT). Stones that fill the renal pelvis and all calyces were defined as staghorn calculi. In order to calculate the total stone area, the area of each stone part located in the calyces and the pelvis was calculated seperately and then added. The area of each stone part was calculated by multiplying the largest vertical and horizontal diameter in millimeters as seen on a plain radiogram. Prior to the operation the patients were consulted with the Hematology Department and were hospitalized for the regulation of bleeding diathesis, blood cell counts and international normalized ratio (INR), as necessary. Coagulation parameters were intensively evaluated. Patients with urinary tract infection were treated by culture specific antibiotic treatment before surgery. All patients were treated with short term prophylactic antibiotics treatment. Intensive medical care facilities were also provided liberally after the operation.

Operations: All of the operations were performed in a single center under general anesthesia. After ureteral catheterization in lithotomy position, the patients were tilted to prone position. The pyelocalyceal system was approached with the insertion of an 18-gauge Chiba needle under fluoroscopic guidance. Tract dilation was achieved either via Amplatz or balloon dilators (MarFlow®, Switzerland) after placement of a safety guide-wire in place. At the end of dilation a 30 F renal sheath was placed and nephroscopy was performed. A pneumatic lithotripter was used for stone fragmentation. The stone fragments were mechanically extracted. A 16 F re-entry nephrostomy catheter was placed at the end of the operation. Operation time was derived from the anesthesia chart and defined as the time elapsed in minutes from the induction of anesthesia until the insertion of nephrostomy catheter. The difference of hemoglobin (ΔHb) calculated by subtracting the hemoglobin value after surgery from the value before surgery was used for the evaluation of blood loss. Postoperative outcome was evaluated using a plain X-ray performed on the morning after procedure and CT at the follow-up. The success rate of the operation was evaluated in three categories; stone free (SF), clinically insignificant residual fragments (CIRF, residual fragments smaller than 4 mm) and clinically significant residual fragments (CSRF, residual fragments larger than 4 mm. For the patients who required additional treatment for stone clearance after PNL, the type and the outcome of additional treatment was recorded. The nephrostomy catheter was withdrawn after antegrade pyelography in the second day after surgery and/or after the gross hematuria cleared. Hospitalization time was defined as the number of days the patient spent at the hospital starting from the day of surgery.

The surgical parameters, outcomes and complications were compared between the HM and control group.

Statistical analyses: To perform a t-test for independent groups, two assumptions have to be satisfied by the data. These assumptions are for each variable, the sampling distribution of differences between group means is normally distributed and homogeneity of variances for groups. Since our data did not fully satisfy these assumptions for some of the variables we performed non-parametric test to compare groups with respect to the variables. Also, since data has small numbers of observations (total n=14) and includes some outliers we preferred to apply non-parametric statistical analysis techniques to the data. As nonparametric test; Mann-Whitney U test was used to compare medians of two independent samples and Chi-square test was performed to test of independence between two variables. We also used Fisher's Exact Test when 2 cells (50%) have expected count less than 5.

Results

There were 3 males and 1 female in HM and 8 males and 2 females in the control groups, respectively. PNL was performed to 3 (75%) left and 1 (25%) right kidneys in HM group, and 7 (70%) left and 3 (30%) right kidneys in the control group. In one of the patients in HM group who was in remission period of CML, the preoperative activated partial thromboplastin time (APTT), prothrombin time (PT) and INR were slightly higher, thus, 57.9 seconds, 15.6 seconds and 1.5 respectively. The Hematology Department offered to treat with 200 ml of fresh frozen plasma (FFP) 12 hours before the operation, thus the APTT, PT and INR values of the patients became to normal range as 38.5 seconds, 14.3 seconds and 1.2, respectively. Also, they suggested blood transfusion in order to increase the hematocrit level up to 28% before the operation since our patient's preoperative level was 24%. Therefore, 2 units of erythrocyte suspension was transfused to the patient, thus the hematocrit level became 33.4%, preoperatively. In one of the patient in HM group who was recently diagnosed as NHL (diffuse large B cell) by lymph node biopsy, the Hematology Department requested PNL operation for left kidney stone prior to chemotherapy regimen in order to relief the obstruction. The patient underwent 7 episodes of chemotherapy regimen consist of 650 mg Rituximab, 1300 mg cyclophosphamide, 85 mg doxorubicin, 2 mg vincristine 6 weeks after the operation. In two other patients in HM group who were in remission period of HL and NHL, there weren't any alterations in coagulation parameters or hematological values, thus no special treatment modality was offered by Hematology Department preoperatively. The mean age, stone area, operation time, fluoroscopy time, ΔHb, blood transfusion rates, hospital stay time and INR values for both of the groups and the corresponding p values are presented in Table 1. Statistical analyses showed no significant differences between HM and control group according to operation parameters except age thus the mean age in control group was significantly higher than the HM group (p=0.002). Preoperative and postoperative white blood cell (WBC) counts and platelet counts were at normal range in both HM and control groups. In HM group, the mean difference of preoperative and postoperative WBC counts was 1740±1200 K/mm3. The access numbers of the groups were presented in Table 2. The success rates for both of groups are presented in Table 3. Statistical analyses revealed no significant differences between HM and control groups according to the success rates (p=0.470). In the HM group, 1 (25%) patient with CSRF required extracorporeal shock wave lithotripsy (SWL) as an additional treatment after PNL. The patient became stone free after one session SWL. At 3 months follow-up in the HM group 3 (75%) patients became stone free, 1 (25%) had CIRF. In the control group, 2 (20%) of the patients required SWL as additional treatment after PNL. Both of the patients became stone free after two sessions of SWL for each. Three (30%) of the patients who had CIRF were followed without any treatment. At 3 months follow-up in the control group 7 (70%) of the patients became stone free, 3 (30%) had CIRF. Statistical analyses revealed no significant difference between groups for additional treatment requirements (p=0.882). The stone analysis revealed whewellite-weddellite stone in the 2 of the patients while uric acid stone in the other 2 of the patients in HM group. Stone analysis was not mentioned in any of the patients in control group.

No major perioperative complication was seen except blood transfusions in 3 of the patients in control group (Grade II, Clavien Classification of Surgical Complications) [4].

Table 1. The operation parameters according to groups

Parameters	HM Group (mean±standart deviation, range)	Control Group (mean±standart deviation, range)	p values
Age	60±2.2 years, (57-62)	70±3.8 years, (66-76)	0.002
Stone area	950±300 mm2 , (600-1200)	1025±230 mm2, (550-1350)	0.776
Operation time	100±38.2 min, (40-120)	135±38.5 min, (90-210)	0.070
Flouroscopy time	1.9±1.1 min, (0.4-2.4)	3.7±2.2 min, (2-9.7)	0.126
ΔHb	0.9±0.5 gr/dl, (0.3-1.5)	2.0±1.8 gr/dl, (0-5.1)	0.240
Transfusion rate	0	30%	0.505
INR	1.038±0.09, (1-1.3)	1.0±0.0, (1)	0.660
Hospitalization time	3.9±2.3 days, (3-4)	3.9±1.1 days, (2-12)	0.999

Table 2. Number of accesses according to groups

Number of Access	HM Group (n)	Control group (n)
1 access	4 (100%)	8 (80%)
2 accesses	0	2 (20%)
3 accesses	0	0
Intercostal access (11-12th rib)	0	1 (10%)

Table 3. The success rates of groups

Success rate	HM Group	Control Group
SF	2 (50%)	5 (50%)
CIRF	1 (25%)	3 (30%)
CSRF	1 (25%)	2 (20%)
F	0	0

SF: Stone free, CIRF: Clinically insignificant residual fragments, CSRF: Clinically significant residual fragments, F: failure

Discussion

The European Association of Urology (EAU) Guidelines recommend PNL treatment for the kidney stones larger than 20 mm within the pelvis and lower or middle or upper calices, also 10-20 mm within the lower calices when the unfavourable factors exist for SWL [5]. Several improvements and modifications have helped to decrease the morbidity of PNL including regional blocks, single step dilatations, miniperc and microperc techniques, tubeless PNL and sandwich therapy [6-9]. The improvements in the technique and increase in the experience of the urologists provide more regular, effective and safer treatment of kidney stone disease with PNL. Consequently, PNL has also become one of the main treatment modalities for kidney stones of patients with co-morbid diseases including diabetes mellitus, hypertension, obesity and impaired renal function [10, 11]. The treatment of kidney stones by PNL operation in patients with HM also requires special consideration. Because, the surgical trauma have the potential risk of increasing the hematological problems, postoperative infection, hemorrhage and leukaemic transformation leading to fatal or morbid complications [3]. Therefore,

surgical strategy in patients with HM must be planned and carried out with the specific aim of decreasing postoperative complications. Previous reports concerning cardiac surgery in patients with HM demonstrated infection as the primary cause of morbidity [2, 12-15]. Some studies showed morbidity rates of between 23 and 57%. Samuels et al. [12] reported the incidence of infectious complications as 42%, underlining the major role they play in the hospital stay [14]. Some investigations emphasised the use of additional intravenous immunoglobulin, as broad-spectrum antibiotic prophylaxis was found to be insufficient to prevent or control infection in these patients [12]. Bleeding is another potential complication in this group of patients. Fecher et al. reported a 16.6% rate of bleeding and it was the main postoperative complication they observed [14]. Finally, the prior reports cited the complication rate between 23 an 57% [12-14]. They concluded that long-term perioperative multidisciplinary follow up and adequate medical treatment are essential in prolonging survival [15].

PNL experience in HM patients with kidney stone is limited and there has been no study reported in the literature yet. In the present study, we evaluated the surgical parameters and outcomes of PNL operations in HM patients with kidney stones and compared with control group. In the 1700 consecutive patients who underwent PNL at our institution, 4 patients (0,25%) had a history of HM diagnosed by Hematology Department. Three of the patients in HM group were initially treated by chemotherapy regimens according to the protocols of Hematology Department in our institution and were considered to be at remission period. The control group was consist of 10 elderly patients who were treated by PNL operation for kidney stone and had no history of operation, HM or any other co-morbide diseases. The insignificant difference between HM and control groups among stone area and INR levels reflects the homogenity of the groups ($p>0.05$). The mean age of the control group was statistically higher than the HM group ($p=0.002$). We especially preferred the elderly patients as a control group in order to eliminate the age affect. The insignificant difference between the groups according to the surgical parameters such as operation time, fluoroscopy time, ΔHb, blood transfusion rates and hospital stay time reflects that hematological malignancy did not negatively affect the performance of the PNL operations ($p>0.05$). Although it didn't reach statistically significance, the operation and flouroscopy time was shorter, the change in the Hb level and transfusion rate was lower in HM group. This might be due to the conservative approach of the surgeons because of the oversensitivity to the patients with known HM. The shorter flouroscopy time in HM group might also be due to the surgeon experience since it was observed that higher experience has statistically significant effect on the duration of fluoroscopy in PNL operations [16]. Statistical analyses revealed no significant differences between the groups according to the success rates ($p=0.470$) and additional treatment requirements ($p=0.882$). Thus, HM did not negatively affect the outcomes of the PNL operation in patients with kidney stones.

Although the general opinion on cardiac surgery is that it does not exacerbate HM in patients in the remission period, a probable increase in WBC count after the surgery may stimulate a leucomoid reaction, which can lead to a relapse in an otherwise quiescent illnes [15, 17]. Since the rate of septic shock after PNL operations has been reported as 2.4% in the literature and preoperative urine WBC count and operation time >90 minutes are two significant risk factors, the HM patients in the remission period prior the PNL surgery still have the risk for complication [18]. However, in our study the surgical trauma didn't lead any increase the hematological problems or leukaemic transformation although a slight increase in WBC count after the operation. But, the surgeon should be aware of the potential risk of septic shock and indirectly leucomoid reaction after the PNL operation especially in the HM patients with increased preoperative WBC count and longer than 90 minutes of operation time.

Also, no other perioperative complication was seen in the patients with HM.

However, there are some limitations of the present study. Firstly, this is a retrospective study. Secondly, the patient number in the HM group is quite low. This is due to the lower insidance of HM with kidney stone in a single centre. A multicentre study with higher patient numbers might be more confidental.

Conclusion

The treatment of kidney stone disease by PNL in patients with hematological malignancy is feasible, safe and effective. However, close cooperation with the Hematology Department to achieve optimal health condition before the operation, maximum precision to the principles of PNL surgery and availability of postoperative intensive care, are of utmost importance in the management of this group of patients. We hope that our study might establish a basis for further studies with higher patient volume in the future.

Competing interests

The authors declare that they have no competing interests.

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