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RESEARCH ARTICLE

Antithrombotic Therapy Does Not Jeopardize Emergency Percutaneous Nephrostomy

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Abstract

Objective: This study aims to evaluate the clinical outcomes of patients receiving antithrombotic (antiaggregant and anticoagulant) therapy who underwent emergency percutaneous nephrostomy (PN) for the treatment of receiving complicated upper urinary tract infection.

Material and Methods: Data of consecutive patients who underwent emergency PN from January 2014 to October 2024 were retrospectively reviewed. A total of 34 patients on antithrombotic treatment (Group 1) and 35 control group patients (Group 2) without bleeding disorders or any antithrombotic treatment were included. Demographics, indications for PN, pre- and post-procedural hematological, biochemical, and microbiological parameters and complications were analyzed.

Results: The mean age was 68.65±1.49 in group 1 and 62.09±1.77 in group 2 (p = 0.006). Sex distribution and indications for PN were comparable between groups. There was no significant difference in emergency PN indications, grade of hydronephrosis, and PN placement sides. The most common antithrombotic agent in group 1 was warfarin (44.1 %). *Escherichia coli* was the most common bacteria isolated in both groups (55.9% vs. 48.6 % for groups 1 and 2, respectively). No major complications were observed in either group. Blood replacement was performed in 4 and 3 patients in groups 1 and 2, respectively. Mean post-procedure Hg levels were similar in both groups (9.53 ±1.39 vs. 9.98 ±1.18 for groups 1 and 2, respectively). No difference in median hospital stay was observed between the groups.

Conclusion: Antithrombotic drugs pose a potential bleeding risk during PN placement. This is the first study in the literature on PN placement in patients on antithrombotic therapy, and it shows that the procedure can be performed with low complication rates in patients on antithrombotic therapy.

Keywords: antiaggregant, anticoagulant, emphysematous pyelonephritis, percutaneous nephrostomy, pyelonephrosis, urological emergency.

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INTRODUCTION

Percutaneous nephrostomy (PN) procedure is the insertion of a catheter through the skin into the renal pelvicalyceal system to drain urine. The first PN procedure was performed by Goodwin et al. in 1955 for the treatment of hydronephrosis (1). The treatment of obstructive pyelonephritis, emphysematous pyelonephritis, pyonephrosis, and renal abscess is emergency renal decompression with PN or ureteral double-J (D-J) stent placement (2).

Emphysematous pyelonephritis was often treated with emergency nephrectomy in the past, but in recent years emergency renal decompression with PN and delayed nephrectomy are usually performed. Percutaneous drainage is thought to reduce the burden of infection and prevent its spread to surrounding tissues (3-5).

Relative contraindications to PN include the use of antithrombotic (antiaggregant or anticoagulant) drugs and coagulopathy (6,7). Life expectancy is increasing, leading to a global rise in the use of antithrombotic therapy (8). In some clinical conditions, emergency PN may be required for patients receiving antithrombotic therapy. Due to the risk of sepsis and septic shock in infectious conditions, there is insufficient time for antithrombotic withdrawal and bridging therapy before emergency PN in patients receiving antithrombotic therapy. The possibility of life-threatening renal hemorrhage requiring blood replacement should be considered in patients undergoing elective PN procedure (9).

Patients on antithrombotic therapy are known to have higher rates of bleeding and complications during PN placement (6,7,10). To date, no comprehensive studies have evaluated the indications and complications of emergency PN in patients receiving antithrombotic therapy. This study evaluated the outcomes of patients on antithrombotic therapy who underwent emergency PN.

MATERIALS AND METHODS

Patients and Data Collection

After approval by the institutional clinical research ethics committee approval, data of consecutive patients who underwent emergency PN in our hospital from January 2014 to October 2024 were retrospectively reviewed. Patients who had undergone open or percutaneous surgery on the same kidney and those who had previously undergone a PN on the same kidney were excluded from the study. Patients reveiving antiplatelet and/or anticoagulant were the antithrombotic group. Antiplatelet drugs included acetylsalicylic acid, clopidogrel. Anticoagulants included warfarin and new generation (dabigatran, rivaroxaban, etc). Thirty-four patients on antithrombotic treatment whose emergency PN was placed for obstructive pyelonephritis, pyonephrosis, renal abscess, retroperitoneal abscess, or emphysematous pyelonephritis, were enrolled in the study as Group 1. In addition, the last 35 consecutive patients whose emergency PN was placed for the same reasons and who didn't have a bleeding disorder or were not on antithrombotic treatment, were enrolled in the study as a control group (Group 2).

Procedure

Patients in Group 1 were informed about the possibility of higher rates of bleeding complications due to emergency PN. All patients received empiric 1 g ceftriaxone and IV hydration prior to the procedure and were confirmed to be hemodynamically stable. No bridging treatment was given to any patient in group 1, and all emergency PN procedures were performed on the same day that the patients were applied. The procedures were performed under local anaesthesia (5-7 cc of 2% 20 mg/ml prilocaine) in the lateral decubitus position, with the target kidney on top, using the Seldinger method, accompanied by ultrasound (11). A 30 cm, pigtail-type, 8 Fr polyurethane nephrostomy catheter was used in all patients. Cultures and antibiotic sensitivity tests were performed to analyze the nephrostomy content in all patients.

After recording of demographic information, the patients were analyzed for PN indications and post-procedural complications. Pre-procedural hydronephrosis grades, white blood cell (WBC) counts, hemoglobin (Hg) levels, creatinine levels, C-reactive protein (CRP) levels, International Normalized Ratio (INR) levels, and platelet count (PLT) levels were documented for all patients. Additionally, first-day the post-procedure results were documented for Hg, WBC count, creatinine level, CRP level, PLT count and culture antibiotic sensitivity.

Statistical Analysis

Statistical analyses were performed using SPSS version 22.0 for Windows software (Armonk, NY: IBM Corp., USA). The Shapiro-Wilk test was used to assess the normality of distributions of continuous variables. Normally distributed continuous variables were compared using the Student's t-test, and non-normally distributed variables were compared using the Mann-Whitney U test. Pearson's chi-square or Fisher's exact test was used for categorical data. Dependent variables were compared using a Paired-Samples T-test or Wilcoxon test depending on their distribution status. Normally distributed continuous variables are expressed as mean ± standard error of the mean (SEM) and non-normally distributed variables as median and interquartile ranges (IQR). Categorical variables are expressed as numbers and percentages. Logistic regression analysis and multiple linear regression analysis were performed to evaluate the association between predictive factors and outcomes. Statistical significance was set at a p-value of less than 0.05.

RESULTS

The mean age of the patients was 68.65±1.49 in group 1 and 62.09±1.77 in group 2 (p=0.006). There was no difference in the gender distribution of the patients between the two groups (p>0.05). Malignancy caused urinary obstruction in 17 (50.0%) patients in Group 1 and 22 (62.9%) patients in Group 2. Six patients in Group 1 had no detectable obstructive cause (stone, malignancy, ureteral stricture, etc.), whereas all patients in Group 2 had urinary obstruction (p=0.034). A total of 30 patients in Group 1 and 16 patients in Group 2 had at least one chronic disease, including diabetes mellitus, hypertension, hyperlipidaemia and cardiovascular disease (p<0.001). Emphysematous pyelonephritis was observed in three patients in group 1 and two patients in group 2. There was no significant difference between the groups regarding indications for emergency PN placement, the grade of hydronephrosis, or the side of PN placement. The most frequently used antithrombotic agent in Group 1 was warfarin (Table 1).

Table 1. Patients' characteristics

		Group 1 (n 34)	Group 2 (n 35)	p Value
Age (mean±SEM)		68.65±1.49	62.09±1.77	**0.006**
Gender (n,%)	Female	18 (52.9)	23 (65.7)	0.280
	Male	16 (47.1)	12 (34.3)	
Etiology (n,%)	Malignancy	17 (50.0)	22 (62.9)	**0.034**
	Urinary stone	11 (32.4)	13 (37.1)	
	Undetected	**6 (17.6)**	**0**	
Chronic disease (n,%)		**30**	**16**	**<0.001**
Main diagnosis (n,%)	Pyelonephritis	14 (41.2)	20 (57.1)	0.510
	Pyelonephrosis	14 (41.2)	12 (34.3)	
	Retroperitoneal abscess	3 (8.8)	1 (2.9)	
	Emphysematous pyelonephritis	3 (8.8)	2 (5.7)	
Side (n,%)	Right	14 (41.2)	12 (34.3)	0.555
	Left	20 (58.8)	23 (65.7)	
Hydronephrosis Grade (n,%)	1	0	0	0.013
	2	9 (26.5)	15 (42.9)	
	3	22 (64.7)	17 (48.6)	
	4	3 (8.8)	3 (8.6)	
Antithrombotics (n,%)	Warfarin	15 (44.1)	-	
	Acetylsalicylic acid	14 (41.2)	-	
	Clopidogrel	3 (8.8)	-	
	New generation	2 (5.9)	-	

SEM: standard error of the mean

Table 2. Blood sample test results

	Group 1 (n 34)	**Group 2 (n 35)**	**p Value**
Hb level (before PN, g/dl)	9.80±0.24	10.28±0.25	0.093
Hb level (after PN, g/dl)	9.53 ±0.24	9.98 ±0.20	0.151
p Value	**0.005**	**0.049**	
WBC count (before PN, cells/mm3)	12.15 (IQR:7.42)	13.44±5.20	0.631
WBC count (after PN, cells/mm3)	11.22±3.01	11.44±3.98	0.791
p Value	**0.003**	**0.001**	
Crp level (before PN, mg/dL)	147.5 (IQR:145.5)	118.0 (IQR:111.0)	0.838
Crp level (after PN, mg/dL)	90.0 (IQR:74.3)	82.5 (IQR:86.0)	0.933
p Value	**<0.001**	**<0.001**	
Cre level (before PN, mg/dL)	3.53 ±1.59	2.5 (IQR:2.76)	**0.011**
Cre level (after PN, mg/dL)	2.18 (IQR:1.09)	1.5 (IQR:1.06)	**<0.001**
p Value	**<0.001**	**<0.001**	
Plt count (before PN, 10^3/µL)	281± 112	261 (IQR:202)	0.904
Plt count (after PN, 10^3/µL)	219± 102	230 (IQR:140)	0.581
p Value	**<0.001**	**<0.001**	
INR level	1.96 (IQR:2.10)	1.17 (IQR:0.15)	**<0.001**

Hg: hemoglobin, WBC: white blood cell, IQR: interquartile range,CRP: C-reactive protein, INR: International Normalized Ratio, Plt: platelet.

Table 3. Clinical outcomes and urine culture results after PN.

		Group 1 (n 34)	**Group 2 (n 35)**	**P Value**
Blood replacement (n,%)		4 (11.7)	3 (8.6)	
Fever >38 °C after PN (n,%)		12 (35.3)	10 (28.6)	0.549
Urine culture (n,%)	*Escherichia coli*	19 (55.9)	17 (48.6)	0.964
	None	8 (23.5)	11 (31.4)	
	candida albicans	0	1 (1.4)	
	enterococcus faecium	2 (5.9)	2 (5.7)	
	klebsiella pneumoniae	2 (5.9)	2 (5.7)	
	proteus mirabilis	1 (2.9)	1 (2.9)	
	pseudomonas aeruginosa	1 (2.9)	0	
	Staphylococcus aureus	1 (2.9)	0	
	Acinetobacter baumannii	0	1 (2.9)	
Leinght of hopital stay (day)		11.50 (IQR:10)	11.00 (IQR:9)	0.318

PN: percutaneous nephrostomy, IQR: interquartile range

As observed, there was no significant difference between the groups in terms of blood test results, both before and after percutaneous nephrostomy placement, except for creatinine and INR levels. The median INR and the median pre- and post-procedure creatinine levels were higher in group 1. Only one patient, with an INR value of 8.80, was injected with 5 mg of vitamin K1 and received 1 unit of fresh frozen plasma infusion before the procedure. Post-procedure levels of Hg, creatinine, WBC, CRP and platelets were significantly lower than pre-procedure levels in both groups (Table 2).

No patient experienced major vascular injury, retroperitoneal bleeding, or hemodynamic instability after PN placement. Twelve patients in group 1 and ten patients in group 2 had a fever above 38°C for 48 hours after the procedure. One patient with an INR of 8.80 had hematuria for 5 days after PN, and 1 unit of erythrocyte suspension was infused. Blood replacement was performed in four and three patients in groups 1 and 2, respectively. There were no Clavien-Dindo grade III or higher complications occurred in any patient. *Escherichia coli* was the most frequently isolated pathogen in the urine cultures of patients in both groups. There was no significant difference in the median length of hospital stay (days) between the groups [11.50 (IQR:10) vs. 11.00 (IQR:9)], (Table 3).

In logistic regression analysis, high INR significantly indicated an association with a higher blood replacement ratio (OR: 1.75; $p = 0.035$). Other factors, including antithrombotic therapy, presence of chronic disease, and platelet level, were not significantly associated with blood replacement ($p > 0.05$). The presence of a chronic disease was found to be significantly associated with the longer length of hospital stay in multiple linear regression analysis ($p = 0.037$).

None of the patients underwent an emergency nephrectomy. Elective nephrectomy was performed in 3 patients in all groups, with emphysematous pyelonephritis 2 months after PN placement.

DISCUSSION

Since its first description, PN has been one of the most commonly performed procedures in daily urological practice (1). Since Pedersen's description of ultrasound-guided PN alone, it has also become feasible even in the office setting (12). With the increasing image quality of modern ultrasound equipment, the success rate of PN placement in the office setting has reached 100% in dilated kidneys (13). In our study, all patients had a grade ≥ 2 renal dilatation degree, and the technical success rate of PN placement was 100% in all patients.

Bleeding diathesis is a relative contraindication for PN placement; however, if intravascular coagulopathy develops due to urosepsis, it is unlikely that the patient's condition can be corrected without PN (6,7).

Decompression of the infected kidney via PN provides clinical improvement, particularly in patients who cannot tolerate major surgery and anaesthesia. During this time, the patient can be more closely ecaluated, potential fluid-electrolyte imbalances can be corrected, the infection can be managed, and valuable time can be gained in preparation for subsequent surgical intervention.

Following PN placement, major complications such as bleeding, sepsis, and injury to adjacent organs have been reported in 3% to 4% of cases (14). The rate of nephrectomy due to bleeding after PN has been reported to be less than 1% (9). In our study, no patient experienced major complications, such as adjacent organ injury or nephrectomy.

In situations involving obstructive pyelonephritis, pyonephrosis, renal-retroperitoneal abscess, and urosepsis, the primary therapeutic approach is urgent decompression through either percutaneous nephrostomy (PN) or placement of a double-J (D-J) stent (15). Furthermore, in cases of pyonephrosis and abscess drainage, the lumen of a D-J stent may be insufficient to adequately drain dense contents or pus.

Emergency nephrectomy is generally favored in the management of emphysematous pyelonephritis, and in current practice, urgent PN is often the first therapeutic step. In a retrospective study of 20 patients with emphysematous pyelonephritis, Shokeir et al. reported a mortality rate of 20% associated with emergency nephrectomy (3). A systematic review of 210 patients diagnosed with emphysematous pyelonephritis, the reported mortality rates were 25% and 13.5% for emergency nephrectomy and PN, respectively (16). Emergency PN makes delayed nephrectomy more reasonable

under more stable conditions after achieving clinical improvement. None of our patients with emphysematous pyelonephritis underwent emergency nephrectomy. Elective nephrectomy was performed in 3 patients with emphysematous pyelonephritis 2 months after PN placement.

Numerous studies have reported that the incidence of major bleeding in patients taking warfarin without surgery ranges from 0.4% to 7.2% per year, while the incidence of minor bleeding can be as high as 15.4% per year (17). In the AVERROES trial, which included 5599 patients, the bleeding rate was 3.8%/year with aspirin and 4.5%/year with apixaban (a new-generation anticoagulant), 18). The use of low-dose acetylsalicylic acid has been shown to increase the risk of major bleeding by about 1.5 times, and chronic diseases such as diabetes mellitus and older age are independent factors that increase the risk of bleeding (19,20). In addition, RCTs reported an equivalent risk of major bleeding with aspirin or clopidogrel compared with warfarin. Bleeding of any severity and intracranial bleeding are less common with antiplatelet drugs than with warfarin (21).

PN placement in patients receiving antithrombotic therapy is known to be associated with a high risk of bleeding (6,7,10). Some studies have suggested that antithrombotics do not increase intraoperative blood loss during emergency gastrointestinal surgery (22,23). However, there is a lack of sufficient data on emergency surgery in patients receiving antithrombotic therapy. To the best of our knowledge, this is the first case-control study of investigating PN placement in patients receiving antithrombotic therapy. According to the results of our study, although the antithrombotic group had a higher rate of chronic disease and a higher mean age of patients, no difference was found between the groups in terms of bleeding complications and Hg lowering.

In our study, emergency PN in patients on antithrombotic medication appeared to be generally safe with low complication rates. The fact that the majority of our patients had grade 2 or higher hydronephrosis and that kidney access was achieved with a single needle puncture in all patients supports the low complication rates. The fact that none of our patients had renal hemorrhage requiring additional intervention after PN supports the fact that emergency PN can be performed when necessary, taking into account the risk/benefit ratio.

The indication for emergency PN in patients on antithrombotic therapy is a rare clinical scenario and resulting in a small sample size. The retrospective nature of the study and the relatively small sample size are the main limitations that may have influenced the results. Prospective randomized controlled trials with large number of patients are needed to determine the safety and clear limits of the applicability of PN in patients on antithrombotic therapy.

CONCLUSIONS

This study suggests that antithrombotic drugs do not significantly increase the risk of complications or bleeding in patients undergoing emergency PN placement. These findings may aid in the clinical decision-making process for the management of patients requiring emergency PN while on antithrombotic therapy.

Informed Consent: Informed consent was obtained from all individual participants included in the study.

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Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional (Antalya Training and Research Hospital, Approval No: 11/15, date 24.08.2023.) and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Authors' Contributions: Conception: SK, ASA Design: SK, ASA, EK Supervision: CO, MS, ST Data Collection: SK, ASA, EK,CO, MS Analysis: SK, MS, ASA Literature Review: SK, EK, CO, MS Writing: SK, ASA, MS Critical Review: SK, ASA, EK, CO, ST.

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