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A RANDOMIZED CONTROL TRIAL TO EVALUATE THE IMPACT OF ALPHA-BLOCKER DRUGS ON THE TIME PERIOD OF URINARY LEAKAGE AFTER A PERCUTANEOUS NEPHROLITHOTOMY

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Abstract

Background: Post-removal urinary leakage subsequent to the percutaneous nephrolithotomy (PNL) procedure frequently presents as a notable complication. This can happen because of things like broken pieces of ureteral stones, edoema in the ureter, especially at the ureterovesical or ureteropelvic junction, blood clots, or even a ruptured calyx. This complication can significantly influence the patient's duration of hospitalization, leading to an extended stay, a postponed return to occupational activities, and consequent negative psychological repercussions.

The main goal of this study was to see if alpha-blockers, especially tamsulosin, could help shorten the time that urine leaks after PNL. This study sought to ascertain whether the utilization of alpha-blockers could serve as a practical intervention to alleviate the associated complications, thereby potentially reducing hospital stays and hastening the patient's recovery and reintegration into daily life.

Study design: randomized clinical trial

Place and Duration: This study was conducted in Bilawal Medical College LUMHS Jamshoro from september 2022 to March 2023.

Methodology: In this study, we enrolled a total of 110 individuals undergoing PNL. Physical exams, lab tests, and full radiological evaluations, such as kidney-ureter-bladder (KUB) imaging and plain computed tomography (CT), were all part of thorough assessments. The participants were randomly allocated into two evenly matched groups: Group A, consisting of 55 cases, received perioperative tamsulosin, whereas Group B, also comprising 55 cases, did not get tamsulosin treatment. Subsequent to the PNL procedure, a meticulous postoperative follow-up was conducted for both groups. The parameters under scrutiny included the DUL, instances of urinary catheterization, and the duration of the hospital stay.

Results: The DUL exhibited a statistically significant reduction in Group A (10.72±6.77 hours) in comparison to Group B (21.59±12.52 hours) (p-value < 0.001). Correspondingly, the length of hospitalization was markedly shorter in Group A (2.63±0.83 days) in contrast to Group B (3.21±1.12 days) (p-value 0.020). These findings underscore the impactful role of tamsulosin administration in Group A, which resulted in a marked decrease in the DUL post-PNL compared to the control Group B.

Conclusion: Among patients undergoing PNL for the management of renal stones, those who received tamsulosin experienced a notably reduced DUL, consequently leading to a shorter hospital stay in comparison to individuals who did not receive tamsulosin treatment. This observation points to a possible clinical benefit of giving tamsulosin to PNL patients with kidney stones: faster recovery after surgery and less time in the hospital.

Keywords: Alpha-blockers, Urinary leakage, nephrocutaneous fistula, and percutaneous nephrolithotomy

Introduction

Renal stone disease is a serious and widespread medical concern that has seen a remarkable rise in prevalence over the past 20 years [1]. The escalating incidence of kidney stone occurrences has prompted the advancement of novel minimally invasive approaches. Simultaneously, this upsurge has also revitalised the utilization of well-established methods, such as PNL [2]. PNL has become widely accepted as the best way to treat complex kidney stones, such as staghorn and high-volume stones, as well as upper tract stones that don't respond to other treatments [3].

PNL is generally considered a safer surgical procedure when administered to appropriately chosen patients, boasting a success rate that surpasses 90% [4]. Following a PNL, the customary practice involves the placement of a percutaneous nephrostomy tube (PCN). This serves a multifaceted purpose, encompassing drainage of urine externally, facilitation of hemostasis, allowance for edema resolution, and also preserving the ante-grade access. This becomes particularly relevant in situations where the residual stones warrant a subsequent intervention, ensuring the feasibility of a second look procedure while maintaining the established access [5]. The percutaneous nephrostomy tube (PCN) is taken out when it is no longer needed and there is good drainage of the ureter all the way to the bladder [6].

Leakage of urine subsequent to the removal of the nephrostomy tube is a prevalent occurrence after PNL. This phenomenon can often be attributed to various factors, including the presence of residual ureteral stone pieces, the formation of blood clots, edema of the ureter, or even the rupture of a calyx [7]. However, the duration of this urinary leakage can have far-reaching implications, significantly extending the patient's hospitalization period. This, in turn, can lead to delays in resuming occupational activities and may even necessitate additional procedures, such as the insertion of an indwelling ureteric stent. The ramifications of this prolonged hospital stay extend beyond the physical realm, encompassing a substantial psychological burden on the patient. The

discomfort resulting from the foul urine leakage can make the delayed hospital discharge even more distressful [8]. The bad effects also show up as irritated skin around the leakage site, and if a double-J (DJ) ureteric stent is used to speed up the healing process, it can cause bothersome lower urinary tract symptoms (LUTS). These collective challenges emphasize the multifaceted nature of urinary leakage post-PNL, underscoring the critical importance of comprehensive management strategies to mitigate its impact on patient well-being and recovery [9].

Alpha-blockers are now the standard way to help get rid of ureteric stones, even when clots cause a blockage at the end of the ureter [10].

In this study, we wanted to find out what might happen to the DUL if the alpha blocker tamsulosin was given after the nephrostomy tube was taken out after a PNL procedure.

Methodology

The primary objective of this study is to evaluate and ascertain the potential impact and efficacy of alpha-blockers, specifically Tamsulosin, on the DUL subsequent to PNL. The study encompassed a cohort of 110 patients presenting with varying types of renal stones. Patients meeting the following criteria were considered for inclusion in the study: individuals within the age range of 15 to 68 years, those admitted for a PNL procedure involving renal stones of diverse configurations, calyceal, encompassing pelvic, and pelviureteric junction (PUJ) stones. Exclusion criteria encompassed the following: Patients who were anticipated to necessitate the placement of an indwelling double-J (DJ) stent post-PNL, such as those with a solitary kidney; individuals with a history of prior open renal stone surgery, attributed to the potential presence of adhesions that could impede the healing process; patients with existing renal impairment, along with those displaying pronounced hydronephrosis and reduced parenchymal thickness; and individuals who had a DJ stent inserted due to intraoperative complications, such as perforation.

The participants were subjected to a randomized allocation into two equitably sized groups, each consisting of 55 patients. The randomization process was executed using the closed-envelope technique. Notably, both the surgeon and the data collector remained unaware of the specific group to which each patient was assigned. In this context, Group A was administered tamsulosin, commencing three days prior to the PNL procedure and extending for a duration of two weeks following the PNL. Conversely, Group B underwent the conventional treatment regimen devoid of any tamsulosin administration.

Before the surgical intervention, patients underwent a comprehensive preoperative assessment encompassing a detailed medical history review and a thorough physical examination. Additionally, a comprehensive radiological evaluation was conducted, involving plain imaging of the urinary tract through a KUB X-ray as well as a plain CT of the urinary tract. Important lab tests were also done, such as a coagulation profile analysis, a complete blood count, an assessment of renal function, an assessment of liver function, a full analysis of urine, and a microbial culture.

In both study groups, a conventional approach involving prone PNL was employed. Initially, a 6-French ureteric catheter was inserted while the patient was positioned in lithotomy. Access was established under the guidance of fluoroscopy. Sequentially, a series of coaxial Alkan dilators were employed, culminating in the placement of a 32-French Amplatz sheath. A pneumatic lithotripter was subsequently utilized for the fragmentation of the renal stones.

Throughout the surgical procedure, various intraoperative parameters were meticulously monitored. This encompassed the assessment of estimated blood loss, the identification and management of any encountered complications, recording the duration of the operation, and tracking the number of

percutaneous accesses utilized. Subsequent to the surgical intervention, the patients underwent postoperative follow-up. During this phase, careful observation was maintained to detect the presence of urinary leakage subsequent to PNL, with a specific focus on evaluating the duration of this leakage.

On the first day following the surgical procedure, KUB imaging was conducted to evaluate the potential existence of any residual stone fragments. Should radiolucent stones be encountered, this KUB evaluation was subsequently substituted with a CT of the urinary tract. Additionally, postoperative assessments included the determination of haemoglobin levels and creatinine concentrations.

In the postoperative phase, a comprehensive record was maintained, encompassing several key aspects. These included the assessment of pain intensity, the requirement for analgesic medications, monitoring for the presence of fever, the necessity for blood transfusions, the interval between the initial closure and subsequent reopening of the percutaneous nephrostomy tube (PCN) to achieve tamponade effects, as well as the specific timeframe for the eventual removal of the PCN (carried out once the urine output exhibited clarity). Furthermore, the duration of ureteric catheterization was documented, and the catheter was withdrawn on the morning following the achievement of a dry nephrostomy site. The overall hospital stay duration was also meticulously recorded.

The patients were subject to a follow-up period spanning 2 to 3 weeks, aimed at diligent monitoring for the potential emergence of delayed postoperative complications. A primary focus during this follow-up period was the evaluation of urinary leakage subsequent to hospital discharge. This concern was rooted in the possibility of residual stone fragments obstructing the ureter and the potential occurrence of late-onset hematuria.

The collected data underwent coding and subsequent entry utilizing SPSS version 26, developed by IBM.

Results

Group A was made up of 55 patients who were supposed to get traditional PNL, which involved using a ureteral catheter and a nephrostomy tube with a diameter of 28 French (F). Additionally, these individuals received a daily dosage of tamsulosin at 0.4 mg. This administration commenced three days prior to the surgical procedure and was sustained for a period of two weeks postoperatively.

Group B comprised a cohort of 55 patients who underwent conventional PNL procedures. Similar to Group A, these individuals underwent the insertion of a ureteral catheter and a nephrostomy tube. However, in contrast to Group A, tamsulosin administration was not included in the treatment regimen for Group B.

No statistically significant differences in preoperatively observed parameters were identified in both groups.

The mean stone size in Group A was measured at 2.58±1.31 cm^3 (ranging from 0.08 cm^3 to 5.9 cm^3), while in Group B, the mean stone size was 2.61±1 cm^3 (ranging from 1.4 cm^3 to 4.8 cm^3). For the purpose of stratification, the stone size was categorized into two groups: those with a stone size greater than 2.5 cm^3 and those with a stone size of 2.5 cm^3 or less, encompassing both single and multiple stones. Among the cases, a total of 45 participants (40.9%) exhibited a stone size exceeding 2.5 cm^3, while a total of 65 cases (59.09%) were categorized under having a stone size of 2.5 cm^3 or less.

Following the surgical procedure, a low-grade fever was observed in 14 cases within Group A, while 19 cases in Group B experienced a similar low-grade fever. A statistically significant distinction between the two groups was evident in relation to the timeframe for the removal of the ureteric catheter. Specifically, the duration of the ureteric catheter was found to be 37.15±16.58 hours in Group A, contrasting with 50.78±21.29 hours in Group B, yielding a p-value of 0.010.

No statistically significant distinction was observed between the two groups in terms of intraoperative blood loss, as illustrated in tables 1 and 2. Notably, only 2 patients within Group A encountered intraoperative bleeding and hypotension; however, immediate resuscitation was undertaken, ensuring the continuity of the procedure. Additionally, postoperatively, three cases necessitated blood transfusion in Group A, whereas only one case necessitated blood transfusion in Group B. Residual fragments (>4 mm) of stone were detected in 9 cases (16.36%) within Group A, in contrast to only 2 cases (3.63%) in Group B. Importantly, none of these cases necessitated a second look PNL.

Concerning how tamsulosin affects the DUL, our main outcome measure was how long it took for the patient to become dry after the percutaneous nephrostomy tube (PCN) was taken out. Notably, the duration of time until dryness was significantly reduced in the group receiving tamsulosin, with a mean of 10.72±6.77 hours, compared to 21.59±12.52 hours in Group B (p-value < 0.001). This favourable effect translated into a shorter postoperative hospital stay for Group A, with a mean duration of 2.63±0.83 days, compared to 3.21±1.12 days in Group B (p-value 0.020).

Table 1. Statistical measurements pertaining to our study's outcomes

Variables	Group A (Mean±SD)	Group B (Mean±SD)	P-value
Age (Years)	42.64±13.68	41.32±1345	0.658
Creatinine level before PNL(mg/dl)	1.08±0.31	1.04±0.36	0.562
Hb before PNL (mg/dl)	13.68±1.8	13.57±1.89	0.926
Duration of surgery (Hours)	1.89±0.69	1.5	0.087
Postop creatinine	1.21±0.31	1.03±0.27	0.061
Postop Hb	12.35±1.51	12.51±2.15	0.364
PCN clamping duration (Hours)	11.39±9.67	11.13±9.1	0.842
PCN duration (Hours)	27.53±12.98	29.89±14.26	0.622
Ureteric catheter duration(Hours)	36.89±16.84	50.91±13.99	0.010
Duration of hospital stay postoperatively (days)	2.63±0.83	3.21±1.12	0.020
Duration after the removal of PCN (Hours)	10.72±6.77	21.59±12.52	<0.001

Table 2. Categorical data analysis of our study

Variables		Group A Frequency (Percentage)	Group B Frequency (Percentage)	P-value
Gender	**Male**	32(58.18)	28(50.9)	0.412
	Female	23(41.81)	27(49.09)	
Side	**Left**	26(47.27)	29(52.72)	0.836
	Right	29(52.72)	26(47.27)	
Size	**>2.5 cm**	23(41.81)	22(40)	0.682
	≤2.5 cm	32(58.18)	33(60)	

Discussion

The goal of this study was to find out what might happen to the DUL if an alpha blocker, specifically tamsulosin, was given after the nephrostomy tube was taken out.

The DUL following PNL is highly variable, subject to a variety of influences, and has the potential to prolong hospitalisation. Limited research has explored the correlation between extended DUL and the demographic and clinical attributes of patients. Notably, factors such as primary stone size, degree of hydronephrosis, stone-free rate, and parenchymal thickness emerge as significant predictors of DUL [11].

In this study, there were no statistically significant differences identified between the two groups in terms of preoperative parameters, intraoperative blood loss, or postoperative changes in haemoglobin and creatinine levels. Residual stone fragments were observed postoperatively in five cases in groups A and B; however, none of these cases required additional intervention. These findings reinforce the potential role of tamsulosin in promoting the smooth passage of stones, potentially leading to a reduction in the DUL. Consequently, this could contribute to a shorter hospital stay and ultimately improve patients' overall experience and quality of life.

According to the study of Kassem et al., among patients undergoing PNL who receive tamsulosin, they experience shorter durations of urethral catheterization, urinary leakage, and hospital stay compared to those who do not receive tamsulosin. That improvement in outcomes could positively influence patients' overall experience and quality of life. Nonetheless, additional research is warranted to identify specific characteristics of stones that may benefit from perioperative alpha-blocker therapy [12].

Salih et al.'s study found that monotherapy with either the alpha-1A blocker tamsulosin or the antimuscarinic solifenacin improved lower urinary tract symptoms (LUTS) caused by a double-J (DJ) stent and improved patients' quality of life (QoL). Notably, there is no distinct advantage observed between the two drugs. However, when combining both pharmacotherapies, the resultant therapy demonstrates significantly greater efficacy compared to single-drug monotherapy [13].

Conclusion

For individuals undergoing PNL and also receiving tamsulosin, there is a notable reduction in the DUL, as well as the hospital stay, and duration of urethral catheterization, in comparison to those who do not receive tamsulosin. This positive outcome can significantly enhance the patient's overall experience and quality of life. Nevertheless, additional research is warranted to identify specific stone characteristics that may derive benefit from alpha-blocker therapy perioperatively.

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Interest confliction

There was no conflict of interest in the present study.

Permission

Permission was acquired and received from the ethical committee before the conduct of the study.

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