

The impact of urinary bladder catheterisation after ureterorenoscopic stone removal on the postoperative course

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Introduction The most frequent reason for ureterorenoscopy is the necessity to remove calculi from the ureter and/or kidney. After completing this procedure the Foley catheter is inserted in the bladder. The aim of the study is to show whether catheterisation of the bladder after ureterorenoscopic stone removal in patients with a low-risk of complications is necessary and indicated.

Material and methods This is a comparative, prospective and randomized study. 100 patients meeting the assumed criteria, subjected to the ureterorenoscopy due to ureter and/or kidney stones participated in the study. The patients were divided into the experimental (Group I) and control (Group II) groups. Group I did not have a catheter, Group II was catheterised. There were two subgroups: female and male in each group. Mean values of the following parameters were calculated: intensity of postoperative pain measured by Visual Analog Pain Scale, the number of additional doses of painkillers administered after the procedure, hospital stay, occurrence of fever, significant bacteriuria, acute urinary retention and post-void retention greater than 30 ml.

Results Intensity of pain measured by the Visual Analog Scale was higher in Group II. Catheterisation does not influence: the number of additional doses of ketoprofen and pethidine administered during the 1st day after the operation, the duration of hospitalization, the occurrence of fever, significant bacteriuria, the post-operative acute urinary retention and the post-void residual urine volume.

Conclusions In patients with a low risk of postoperative complications who did not have any intraoperative complications, catheterisation of the urinary bladder increases discomfort without bringing any benefits.

Key Words: urolithiasis ↔ ureterorenoscopy ↔ urinary bladder catheterisation

INTRODUCTION

Removal of calculi from the urinary tract by means of ureterorenoscopy (URS) is one of the most frequent surgical procedures in urology. A catheter is usually left in the urinary bladder after the procedure. A question thus arises, whether catheterisation is an integral part of the procedure or results from acquired routine.

The goal of the study was to provide evidence whether, urinary bladder catheterisation, applied after ureterorenoscopic removal of stones from the ureter and/or the kidney in patients with a low risk

of complications from the lower urinary tract, has any impact on selected aspects in the post-operative follow-up.

MATERIAL AND METHODS

The study was designed as a prospective, randomized trial. The written informed consent was obtained from all patients. The approval of the Bioethics Committee was obtained.

The patients were divided in two groups: experimental and control. After the surgery, patients from the experimental group (Group I) were not

catheterised, while patients from the control group (Group II) had catheters left in their bladders. Both groups were gender subdivided into female and male (FI and MI vs. FII and MII, respectively). Each of the qualified patients had to meet the predefined inclusion criteria, while not meeting any of the exclusion criteria. Inclusion criteria were as follows: age >18 years, successful URS under subarachnoid spinal block, application of the JJ stent, unified analgesic therapy, unified anti-bacterial prophylaxis and in the control group presence Foley catheter. The exclusion criteria were: urinary tract infection, urinalysis positive for infection, post-void residual (PVR) >30 ml, alcoholism, neurological conditions with disturbed uresis, post-operative or post-radiotherapy condition of the pelvis minor and/or the retroperitoneal space, immunodeficiency, diabetes mellitus, significant clinical complications of URS, surgical procedures in the urinary system other than URS and no patient willingness to collaborate. In the course of hospitalisation of each included patient, the following data were acquired concerning his/her therapy: the highest severity of post-operative pain, determined by means of the Visual Analogue Scale (VAS) of Pain on the first day after operation, the number of doses of ketoprofen and pethidine administered in the first day after surgery, post-operative hospitalisation period in days,

post-operative fever, post-operative bacteriuria, post-operative acute urinary retention (AUR) and post-operative PVR >30 ml.

Statistical analysis was performed with the chi-square, Fisher's exact and U Mann-Whitney exact tests. It was assumed that the difference was significant under $P < 0.05$, and highly significant when $P < 0.01$.

RESULTS

The mean severity of post-operative pain on the first day after surgery is presented in Table 1 and Figure 1. It was confirmed that the catheterised patients had sensed more intensive pain than the non-catheterised subjects. Both in the group of women and in the group of men, a significant correlation of the highest post-operative pain severity, determined by means of the Visual Analogue Scale (VAS) of Pain, with catheterisation was found.

No significant differences were found in the amount of pethidine or ketoprofen additionally administered on the 1st day after catheterisation, both in total as well as separately in men and women. There was also no significant difference in the post-operative hospital stay between the groups, both in total and separately in women and in men. No fever occurred after surgery in any of the patients – there

Table 1. Distribution of the most severe post-operative pain on the first day after surgery in VAS, with regards to catheterisation

Pain severity in VAS	Total			Women			Men		
	Catheterisation		Line Total	Catheterisation		Line Total	Catheterisation		Line Total
	no	yes		no	yes		no	yes	
0	27	9	36	14	4	18	13	5	18
	54%	18%		56%	16%		52%	20%	
1	3	3	6	0	1	1	3	2	5
	6%	6%		0%	4%		12%	8%	
2	9	12	21	4	7	11	5	5	10
	18%	24%		16%	28%		20%	20%	
3	7	11	18	5	6	11	2	5	7
	14%	22%		20%	24%		8%	20%	
4	3	3	6	2	1	3	1	2	3
	6%	6%		8%	4%		4%	8%	
5	1	4	5	0	3	3	1	1	2
	2%	8%		0%	12%		4%	4%	
6	0	4	4	0	1	1	0	3	3
	0%	8%		0%	4%		0%	12%	
8	0	4	4	0	2	2	0	2	2
	0%	8%		0%	8%		0%	8%	
Total	50	50	100	25	25	50	25	25	50

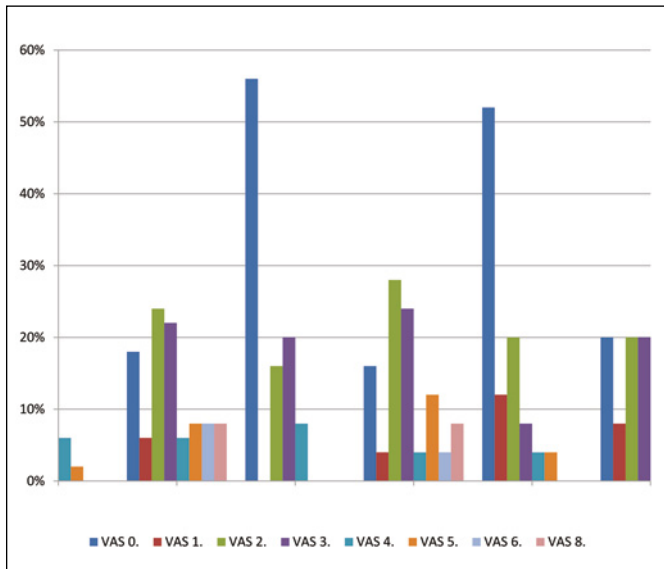


Figure 1. Distribution of the most severe post-operative pain on the first day after surgery in VAS, depending on catheterisation.

were no differences among the groups. Presence of the post-operative positive urine culture was not significantly dependent on catheterisation. No significant correlation was found in the post operative AUR and PVR >30 ml on the day of discharge depending on catheterisation, both in total and separately in women and in men.

DISCUSSION

Post-surgical catheterisation of the urinary bladder is carried out for a certain number of causes.

The main reason for bladder catheterisation is the risk of acute urinary retention (AUR) as a complication of anaesthesia. The percent of post-operative urinary retention varies from 2.1 to 2.52% for all types of surgery [1, 2], while for surgical procedures under spinal anaesthesia it is 0–79% [3, 4]. The occurrence of AUR under subarachnoid anaesthesia depends, among others, on the type and dose of an intrathecally administered drug [3, 5–10]. Intralumbar anaesthesia with amide derivatives results in atony of the urinary bladder, mainly as a result of blockade of the S2–S4 parasympathetic sacral segments. Post-operative urinary retention (POUR) may also be a consequence of urinary bladder atony, caused by excessive bladder wall extension by urine accumulating in the bladder during surgery. The risk increases with operation time, the volume of administered fluids and urine volume in the bladder when the patient was transferred to the post-operative unit [8, 9, 11, 12]. Oedema and/or lesions of the urethra, the prostate gland, the urinary bladder neck

or of the genital organ in women may cause a secondary subvesical obstruction [2, 9, 12]. The risk increases if the patients presented with lower urinary tract symptoms (LUTS) or had been treated for bladder outlet obstruction before surgery [7, 8, 12, 13, 14]. Following certain reports, diabetes mellitus, renal insufficiency, neuropathies and depression increase the risk of POUR [1, 12–15], while other reports do not confirm such correlations [16]. Some publications mention the male gender and age as the risk factors [1, 2, 13, 14, 16], while other do not confirm such correlations [8, 12, 15, 16].

In the study all patients were submitted to subarachnoid anaesthesia, using heavy lidocaine, which assured homogeneity in the aspect of POUR as an anaesthetic complication. It is assumed that a lower percent of POUR is observed after the administration of lidocaine and procaine than after bupivacaine or tetracaine [9].

Bladder emptying during and after URS is an integral part of the procedure. Significant clinical, intra-operative lesions of the urinary tract were among the exclusion criteria, similarly to diabetes mellitus, diseases of the nervous system with miction disorders, identified and confirmed, considerable, preoperative urine retention after miction as an important indicator of bladder outlet obstruction, as well as previous surgical operations and/or therapeutic irradiation, which could have impaired the innervation of the lower urinary tract. Their role as a risk factor for POUR had no effect on the results of the study.

A urinary bladder catheter allows for monitoring of haematuria and reduces the risk of urine drainage block by clots [17]. Scarce haematuria occurred in 40% of URS procedures, carried out for urolithiasis of the upper urinary tract [18]. In turn, Tanriverdi and Geavlete reported 0.1% to 3.2% of medium degree haematuria cases [19, 20]. No severe cases of haematuria were noted.

In line with literature reports, no cases of severe haematuria were observed in the study, thus it also could not be an indication to apply a urinary catheter or have any potential effect on the actual POUR. Urinary bladder catheterisation ensures drainage of urine which may contain microorganisms and elements of a substrate for biofilm [21, 22, 23] and thus prevents infection complications.

Preoperative urinary tract infections (UTI), identified by clinical symptoms or confirmed in urine culture, were among the exclusion criteria. Thus, since there were no cases of severe UTI, it could not be regarded as an indication for catheterisation of the patients included into the study.

A bladder catheter facilitates monitoring of diuresis after surgery [5, 15]. It is applied mainly in patients

with a high risk of post-operative occurrence of renal or prerenal kidney failure [24, 25]. In the other cases, the anaesthetic indications for urinary bladder catheterisations are rather ambiguous.

None of the patients from the study groups required urine output measurements as an element of post-operative monitoring.

The following complications of short-term urinary bladder catheterisation are mentioned:

1) A syndrome of complaints of various character and intensity, in response to the presence of the catheter in the bladder is called catheter-related bladder discomfort (CRBD). Catheterised patients complain of pains and burning sensation at the region of the urethral orifice or dull pain in the lower abdominal part. Men sometimes complain of pain in the entire hanging penile urethra. However, the main discomfort results from painful, uncontrolled urinary bladder contractions, induced by the presence of the catheter tip in the bladder lumen. These contractions very much resemble the pain which occur in the overactive bladder (OAB) and depend, among others, on stimulation of the muscarinic receptors [26, 27, 28]. In as much as the former components of CRBD can be alleviated with commonly applied analgesics, the OAB-like components poorly respond to medications from the NSAID group or to opioids [29, 30]. Even a short-term catheterisation of the urinary bladder, applied as a procedure, closing all types of operations, may considerably increase the post-operative discomfort of the patient [28, 29, 31].

2) UTI as a result of urinary bladder catheter installation. Taking into account the high number of catheterised patients, the term CAUTI (Catheter Associated Urinary Tract Infection) has been defined [2, 33, 34, 35]. It is assumed that CAUTIs are the most frequent hospital infections in the world [36]. The number of CAUTIs of all hospitalised patients varies from 1.8% up to 4% [33, 37]. The incidence of CAUTIs among patients, submitted to all kinds of surgical interventions, is higher by 5% with every subsequent day of catheterisation [33, 38].

3) Urethral lesions. According to Kashefi and Leuck, 0.32% and 0.5% of hospitalised and catheterised patients, respectively, present with iatrogenic lesions in this context [39, 40]. Thomas, in his analysis of urethral lesions from iatrogenic causes, writes that 6% of urological consultations at a teaching (university) hospital are carried out with complications of urinary bladder catheterisation in the background. As much as 67% of these complications are associated with urethral lesions [41]. The most severe consequence of iatrogenic urethral lesions is urethrostenosis, most often caused by direct injuries during catheterisation [42, 43].

4) Other complications, observed in catheterisation of the urinary bladder, such as lesions preventing fluid removal from the catheter balloon or other defects of the Foley catheter, are much less frequent [44, 45]. There is some evidence for the assumption that the male gender is an independent risk factor with a powerful impact on the incidence of CRBD or discomfort induced by catheter presence after surgical procedures [46]. This assumption resulted in the subdivision into male and female subgroups in Group I and II. An analysis of acquired data demonstrated a statistically significant difference in post-operative pain intensity. The patients from Group II had higher pain sensations than the patients from Group I, which was a clear correlation to catheterisation.

The harmonised scheme of post-operative pain treatment was based on the intravenous administration of ketoprofen and metamizole in equally divided doses, applied in regular time intervals: metamizole every 4–6 hours and ketoprofen every 8–12 hours. Daily doses of these medications were calculated by an anaesthesiologist with consideration of factors affecting pharmacokinetics. No statistically significant differences were found in the observed demands for additional analgesic doses of the patients from Group I and II, including the subdivision into male and female subgroups.

The mean post-operative hospitalisation stay after surgery lasted 1.19 days and was the same in both groups. It may then be concluded that the lack of Foley catheter in patients from the experimental group was not associated with hospitalisation stay extension by complications of direct invasiveness of the catheter in the urinary bladder.

None of the patients included into the study, presented with post-operative fever. Therefore, one may assume that neither the presence nor the absence of urinary catheter in the patients included into the study could in any way be associated with fever-inducing factors.

All the patients were submitted to urine sampling on the day of discharge. UTI after URS was possible in the following two circumstances: by exo- or endogenous contamination during surgery (Group I and II) and as a result of urinary bladder catheterisation (Group II). There were no statistically significant differences between Group I and Group II, regarding the mean number and percent of patients with significant bacteriuria during post-operative hospitalisation, as confirmed by urine culture tests.

It is assumed that catheterisation in a single patient increases the risk of UTI by 1 to 5%, while every subsequent day of the catheter's presence in the

urinary bladder increases the risk by 5% [37, 40]. The studies of post-operative CAUTIs most often analyse the correlation between the number of CAUTIs and the time period of catheterisation, without reference to any control group without catheter [38, 47]. Some of these studies demonstrated a much lower incidence of CAUTI cases after shorter catheterisation vs. its longer periods [47].

One case of POUR was noted in MI group. Thus there was no statistically significant difference in the number of AUR cases after surgery, depending on catheterisation. Wu and Kang are the authors of reports based on the highest number of patients. The percent of POUR in their studies oscillates between and 2.52% [1, 2]. It would mean then that the number of POUR cases in our study was not much different from its average value. It should simultaneously be noted that the criteria of inclusion into the study, the modes of anaesthesia and the types of procedures significantly reduced the number of described in literature risk factors for POUR. Besides, lidocaine was used for the subarachnoid anaesthesia, which very rarely causes POUR. The time period of surgery (with spinal anaesthesia with lidocaine) did not, as a rule, exceed 2 hours. Therefore, no urinary bladder overfilling took place and the patients did not exhibit any intraoperative or intraoperatively diagnosed cases of pyonephrosis. The results of the reported study suggest then that the lack of Foley catheter after ureterorenoscopic removal of deposits from the ureter and/or from the kidney does not increase the risk in patients from the group of low risk for POUR.

The volume of urine, retained after miction was determined by transabdominal ultrasound on the day of discharge from the ward.

In the literature, one may come across a theme of lack of clear criteria for PVR [48, 49]. Kolman published a report dealing with the quantitative distribution of PVR in the population of healthy

men. Its upper limit is 28 ml of urine retained in the bladder [50]. For this reason, in this reported study, the criterion for PVR diagnosis was 30 ml of urine retained in the bladder after miction.

None of the discharged patients presented with urine volumes, retained after miction, above 30 ml. Thus it may be assumed that urinary bladder catheterisation after URS in patients with low risk for POUR has no effect on the risk for a clinically significant condition of PVR.

CONCLUSIONS

Pain sensations, measured by VAS and by the quantities of additional analgesic medications, administered on the first day after the surgery of stone removal (URS) are higher in patients with a Foley catheter placed in their urinary bladder.

Catheterisation of the urinary bladder after URS in patients with low risk, defined as no obstructions in urine drainage, and with a low risk for urinary tract infections and for metabolic and neurological conditions, has no effect on the post-operative hospitalisation time period nor on the number of post-operative complications, such as fever, urinary tract infections, urine retention after micturition or the risk for acute urine retention on the last day of hospitalisation.

In patients with a low risk for post-operative complications and in those without any serious intraoperative complications, the urinary bladder catheterisation enhances patients' discomfort, while bringing no expected benefits. In such patients, the routine application of urinary bladder catheterisation after successful, uncomplicated URS, should become a subject of thorough and careful consideration.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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