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RETROSPECTIVE ANALYSIS OF THE RESULTS OF TRANSURETHRAL CONTACT PYELOCALYCOLITHOTRIPSY IN PATIENTS WITH KIDNEY STONES

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Transurethral contact lithotripsy is a promising treatment method and occupies an important place among endoscopic methods for removing kidney stones. **The aim** of the study was to identify the advantages and disadvantages of transurethral contact pyelocalycolithotripsy in patients with kidney stones based on retrospective analysis. **Material and methods.** A retrospective analysis of 178 clinical cases of treating patients aged from 19 to 71 years who suffered from kidney stones and underwent transurethral contact pyelocalycolithotripsy was performed. All patients were diagnosed with calculi of the pyelocaliceal system with the diameter ranging from 10 to 20 mm according to multispiral CT data. Renal calculi had different composition and their density varied from 460 HU to 1440 HU. Pneumatic and laser energy was used for lithotripsy in 102 (57.3%) and 76 (42.7%) patients respectively. **Results.** The obtained data show that complete destruction of the stones and the removal of fragments within 2 weeks after transurethral contact pyelocalycolithotripsy was noted in 143 (80.3%) patients. In 140 (78.7%) cases positive results were achieved in one surgical intervention and in 38 (21.3%) patients after two procedures. Complications of this treatment method were relatively rare and included intraoperative bleeding, pelvic perforation, acute pyelonephritis, stent migration, postoperative bleeding, and residual stones. **Conclusion.** Transurethral contact pyelocalycolithotripsy is a promising method due to the fact that in most cases it allows you to simultaneously rid a patient of kidney stones with minimal complications.

Keywords: nephrolithiasis; transurethral contact pyelocalycolithotripsy; complications.

РЕТРОСПЕКТИВНЫЙ АНАЛИЗ РЕЗУЛЬТАТОВ ТРАНСУРЕТРАЛЬНОЙ КОНТАКТНОЙ ПИЕЛОКАЛИКОЛИТОТРИПСИИ У БОЛЬНЫХ НЕФРОЛИТИАЗОМ

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Введение. Трансуретральная контактная литотрипсия является перспективным методом лечения и занимает важное место среди эндоскопических способов удаления камней почек. **Цель исследования.** На основании ретроспективного анализа выявить преимущества и недостатки трансуретральной контактной пиелокаликолитотрипсии пациентов с камнями в почках. **Материал и методы.** Проведен ретроспективный анализ 178 клинических случаев лечения больных в возрасте от 19 до 71 года с камнями в почках методом трансуретральной контактной

пиелокаликолитотрипсии. У всех пациентов были диагностированы конкременты чашечно-лоханочной системы почек от 10 до 20 мм по данным мультиспиральной компьютерной томографии. Камни в почках были различного состава и плотности от 460 до 1440 HU. Для литотрипсии использовали пневматическую и лазерную энергию соответственно у 102 (57,3 %) и 76 (42,7 %) пациентов. **Результаты.** Полученные данные показывают, что полное разрушение камней и отхождение их фрагментов в сроки до 2 недель после трансуретральной контактной пиелокаликолитотрипсии отмечено у 143 (80,3 %) больных, причем в 140 (78,7 %) случаях положительные результаты достигнуты за одно оперативное вмешательство, у 38 (21,3 %) больных — за две процедуры. Осложнения данного метода лечения были относительно редкими и включали интраоперационное кровотечение, перфорацию лоханки, острый пиелонефрит, миграцию стента, кровотечение в послеоперационном этапе и резидуальные камни. **Заключение.** Трансуретральная контактная пиелокаликолитотрипсия является перспективным методом в связи с тем, что позволяет в большинстве случаев одномоментно избавить пациента от камней в почках с минимальными осложнениями.

Ключевые слова: нефролитиаз; трансуретральная контактная пиелокаликолитотрипсия; осложнения.

INTRODUCTION

The incidence of nephrolithiasis ranges from 30% to 40%, thus making it one of the most common urological pathologies [1, 2]. Patients with nephrolithiasis comprise 30% to 50% of those hospitalized in urological hospitals. The number of newly detected cases of nephrolithiasis increases by 2% to 3% every year. About 10% of patients have a relapse after one year and after five years, 40%have a relapse. After 10 years relapse is observed for more than 60% of patients [3–5]. According to international authoritative publications incidence of this pathology is growing steadily everywhere. Every year 1,500–2,000 new cases of primary stone formation per 1 million population are diagnosed in industrially developed countries [6–8].

Till now the main method of a treating urolithiasis was surgical approach, which is characterized by the development of a significant number of complications and disease relapse; therefore the effectiveness of this method was relatively low [9–12]. Recently, because of the development of modern medical technologies, various minimally invasive techniques have become increasingly important in the treatment of patients with nephrolithiasis: laparoscopic pyelotomy and ureterolithotomy, and contact pyelocalycolithotripsy with ureterolithoextraction [13–15]. Due to it's their low injury rate, and a high clinical and economic efficiency, these methods have received well-deserved recognition and widespread use both in Russia and abroad [14, 16–18]

Nowadays the issue of choosing the tactics of an endoscopic removal of stones from the renal cavity system remains debatable. Incorrect approaches to choosing the tactics increase the risk of complications, reduce the quality of life of patients, increase the duration of rehabilitation, the cost of treatment, and often leads to disability of patients [19, 20].

The aim of the study is to identify the advantages and disadvantages of transurethral contact pyelocalycolithotripsy (TUCPCLT) for patients with kidney stones based on a retrospective analysis.

MATERIALS AND METHODS

The analysis was conducted on the results of diagnostics and treatment of 178 patients from 2016 to 2020 years. For planned surgery were hospitalized 144 (80.9%) patients and for emergency 34 (19.1%) patients. 79 patients were men (54.49%)and 81 were women (45.51%). The age of the patients ranged from 19 to 71 years (41.5 years on average).

The main complaint of planned surgery patients with nephrolithiasis most often was pain in the lumbar region on the affected side. The nature of the pain ranged from dull and aching to acute. During an emergency hospitalization patients had renal colic, accompanied by nausea and vomiting and they often had fever, dyspepsia, dysuria and hematuria. In 11.24% (20 patients) of cases patients did not experience pain. This category of patients had other clinical symptoms: hematuria, fever, dysuric disorders and symptomatic arterial hypertension.

Data from laboratory and instrumental research methods have an important place in the diagnosis of nephrolithiasis. All patients underwent a comprehensive examination: clinical and biochemical blood and urine tests, urine culture, ultrasound examination of the urinary system, two-energy computed tomography with densitometry and if necessary radioisotope studies (radioisotope geography with renoscintigraphy) of the kidneys and urinary tract.

Sixty-eight (38.2%) patients had a single attack of a renal colic before the hospitalization and 110 (61.8%) patients had a history of nephrolithiasis lasting from 1 to 32 years and had repeated attacks of a renal colic.

In the total urine analysis changes were detected in 115 (64.61%) patients: hematuria in 71 (39.89%), leukocyturia in 88 (49.44%)and proteinuria in 76 (42.7%). In 63 (35.39%) patients, the total urine analysis was

unchanged. In the clinical blood analysis, leukocytosis and an increase in the rate of erythrocyte sedimentation were observed for 22 (12.36%) patients who had an active phase of chronic calculous pyelonephritis. Changes in the level of urea (up to 12 mmol/L) and creatinine (up to 150 mmol/L), characteristic of chronic kidney failure were detected in the biochemical parameters of blood for 23 (12.9%) patients.

By means of bacterial seeding of urine, the microflora of the patients' urine was determined. For 63 (35.96%) patients bacterial growth was absent and for 115 (64.04%) patients bacteriuria of various degrees was detected: up to 10^4 for 52 (45.61%) patients and up to 10^5 for 62 (54.39%) patients. *Escherichia coli* was the most frequently detected in 27 (23.48%) patients. The hospital strain *Proteus* was present in 17 (14.78%) patients and *Pseudomonas aeruginosa* was present in 14 (12.17%) patients. Other pathogens were detected in 32 (27.82%) cases and bacterial associations were found for 25 (21.74%) patients (table 1).

Among 167 (93.9%) patients X-ray-positive kidney stones were detected while the remaining 11 (6.1%) patients had X-ray-negative stones detected by ultrasound and a multispiral computed tomography. According to renoscintigraphy data satisfactory renal function was detected for 155 (87.07%) patients, and 23 (12.93%) of the studied patients had decreased renal function and expansion of the calico–pelvic system. The results of a scintigraphy were later taken into account to decide treatment tactics. Stones were visualized on ultrasound in all patients. Kidney size, parenchyma thickness and echogenicity, expansion of the calico–pelvic system, and evaluation of the contours of the kidneys and pericardial fiber were determined.

According to a two-energy computed tomography, single kidney concretions were detected. Their sizes varied from 10 to 20 mm with a density of 460 HU to 1440 HU. Depending on the radio intensity of the stones the method of lithotripsy using the energy was determined: in favor of pneumatic, the density is up to 800 HU, or laser, over 800 HU.

The distribution of urinary stones depending on the localization is shown in table 2. All patients had unilateral kidney stones. Concretions on the right side were

Table 1 / Таблица 1

The results of bacteriological examination of urine in patients with urolithiasis (*n* = 115)
Результаты бактериологического исследования мочи у больных уролитиазом (*n* = 115)

The type of microorganism	Number of patients	
	n	%
Collibacillus (*Escherichia coli*)	27	23.48
Proteus (*Proteus* spp.)	17	14.78
Enterobacter (*Enterobacter* spp.)	5	4.35
Blue pus bacillus (*Pseudomonasaeruginosa*)	14	12.17
Klebsiella (*Klebsiella* spp.)	6	5.22
Staphylococcus (*Staphylococcus* spp.)	8	6.96
Streptococcus (*Streptococcus* spp.)	9	7.83
Other bacteria (single observations)	4	3.48
Associations of microbes	25	21.74
Total	115	100

Table 2 / Таблица 2

Localization of urinary stones in the pyelocaliceal system of the kidney (*n* = 178)
Локализация мочевых камней в чашечно-лоханочной системе почки (*n* = 178)

Localization		Presence of concrements				Total	
		on the right		on the left		*n*	%
		n	%	*n*	%		
Calixes	upper	18	17.27	13	17.55	31	17.42
	average	33	32.53	23	30.21	56	31.46
	lower	26	25.94	26	34.43	52	29.21
Pelvis of kidney		25	24.26	14	17.81	39	21.91
Total		102	57.38	76	42.62	178	100

found in 102 (57.38%) and on the left in 76 (42.62%) patients. At the same time, tub concretions were found in 25 (24.26%) and 14 (17.81%) of the patients accordingly. Calyx concretions were found on the right side in 77 (75.74%), and on the left they were found in 62 (24.26%) patients.

After a comprehensive examination all patients got therapy, including preoperative preparation and postoperative prescribing of drugs with anti-inflammatory and antibacterial effects.

In 12.36% (22 patients) of cases preliminary drainage of the upper urinary tract was made: 8.99% (16 patients) by ureteral stenting, and 3.37% (6 patients) by percutaneous nephrostomy. Indications for stenting before transurethral contact pyelocalycolithotripsy were large (from 15 to 20 mm) kidney stones and the presence of signs of acute pyelonephritis. Stents were used to facilitate the crushing of large stones and to prevent ureteral obstruction with stone fragments after transurethral contact pyelocalycolithotripsy. The removal of the obstruction prevented the development of a pyelonephritis attack and allowed the kidney to be finally freed from stone fragments in the future.

Endoscopic operations were made using units with various mechanisms of an energy generation: pneumatic in 102 (57.3%) patients and laser in 76 (42.7%) patients. We used ureteropieloscopes produced by Karl Storz (Germany), which had one working channel with a pneumatic lithotriptor Swiss Lithoclast Master (EMS, Switzerland). As a source of a laser radiation, a Calculase unit (produced by Karl Storz, model: 27750120-1, s/n FB2269) was used.

For 93 (52.25%) patients with kidney stones (the size of the concretion from 10 to 15 mm)transurethral contact pyelocalycolithotripsy with a lithoextraction was made, and the "stone-free rate" was reached, and for 59 (33.15%) patients with the size of the concretion from 15 to 20 mm after transurethral contact pyelocalycolithotripsy there were single residual kidney stones of no more than 5 mm, which tended to separate. All patients after lithotripsy were fitted with ureteral stents for a period of 1 to 2 months.

RESULTS AND DISCUSSION

We analyzed the results of treatment of 178 patients: 111 (62.36%) patients got 1 to 4 extracorporeal shock wave lithotripsy sessions without effect before an endoscopic surgery. Only 53 (29.78%) patients had transurethral contact pyelocalycolithotripsy as the primary method of a treatment.

Transurethral contact pyelocalycolithotripsy was the main method of treatment for patients with nephrolithiasis. According to the obtained data complete destruction of stones and removal of fragments up to 2 weeks after transurethral contact pyelocalycolithotripsy was observed for 143 (80.3%) patients. In 140 (78.7%) cases positive results were achieved after one surgical intervention and 38 (21.3%) patients achieved positive results after two surgical interventions.

We analyzed intra-and postoperative surgery complications (table 3). Migration of stones to the calyx during transurethral contact pyelocalycolithotripsy was observed in 24 (13.48%) patients with concretion sizes <15 mm. These patients were fitted with a ureteral stent. Subsequently, a successful surgical intervention was made in a planned manner using this technology.

In 2 (1.12%) cases the pelvis perforation was marked by a conductor string and was punctate and in another case a pelvis injury was noted after using a pneumatic lithotripsy, which was associated with damage to the pelvis wall in contact with the lithotripter probe. In 3 (1.69%) cases the operation was stopped and the pelvis was drained by an internal stent. No patients needed an open approach kidney surgery after transurethral con-

Table 3 / Таблица 3

Intra- and postoperative complications of transurethral contact pyelocalicolithotripsy
Интра- и послеоперационные осложнения трансуретральной контактной пиелокаликолитотрипсии

Type of complications	Number	Consequence
Intraoperative bleeding	11 (6.18%)	Hemostasis, a conservative therapy
Perforation of the pelvis	3 (1.69%)	Installation of an internal stent, completion of a surgery
Acute pyelonephritis	24 (13.48%)	Conservative therapy
Migration of the stent	8 (4.49%)	Correction of the stent
Gross hematuria in the postoperative phase	2 (1.12%)	Conservative therapy
Migration of a concretion	24 (13.48%)	Stent placement followed by a lithotripsy

tact pyelocalycolithotripsy and all patients subsequently had successful repeated surgery.

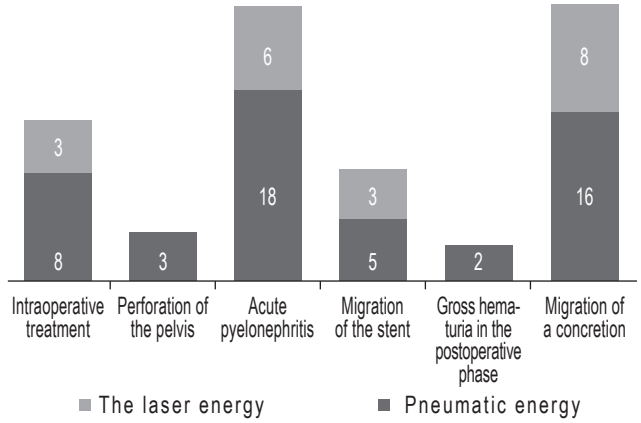
One of the most frequent postoperative complications was exacerbation of pyelonephritis, which was observed in 24 (13.48%) patients and in all cases was stopped using conservative methods. The main risk factors were the presence of pre-surgery nephrostomic drainage or an internal ureteral stent. Stent migration was observed in 8 (4.49%) patients in the postoperative period, which led to an exacerbation of pyelonephritis in seven (3.93%) patients and required a stent correction.

In 11 (6.18%) cases intraoperative bleeding started which made it difficult to continue performing transurethral contact pyelocalycolithotripsy and it was impossible to complete removal of all stone fragments and the bleeding was stopped conservatively with hemostatic therapy. The maximum term of relief of this complication for patients was two days. In all cases the developed complication did not require conversion and transition to an open surgery. It is noteworthy that intraoperatively and in the early postoperative period, there were no cases of hypotension or a marked decrease in hemoglobin levels of patients.

Complications depending on the energy used are shown in Fig. 1. There is an obvious advantage of using a laser energy for patients at transurethral contact pyelocalycolithotripsy, which confirms the opinion of authoritative authors.

Thus, based on the results obtained from the conducted retrospective analysis, the following diagnostic tactics and treatment measures are recommended for patients with nephrolithiasis with single kidney concretions. Of the diagnostic methods, the most important are the clinical and biochemical indicators of general blood and urine analysis and the radiological methods of diagnosis: a two-energy computed tomography. The most effective way to remove stones from patients with nephrolithiasis at their size from 10 to 20 mm is considered to be transurethral contact pyelocalycolithotripsy. In case of a disbalance of the urodynamics of the upper urinary tract it is recommended to conduct a preliminary drainage of the kidney with the appointment of an anti-inflammatory and antibacterial therapy.

It should be noted that the advantages of transurethral contact pyelocalycolithotripsy include it being minimally invasive, low trauma, the possibility of complete disposal of the patient from the stone in one intervention, and reduction in the time of hospitalization.



Complications of transurethral contact pyelocalicolithotripsy depending on the type of energy used

Осложнения трансуретральной контактной пиелокаликолитотрипсии в зависимости от вида использованной энергии

Despite all the advantages, the method of transurethral contact pyelocalycolithotripsyhas some disadvantages. The main complication of this operation is considered to be a damage to the kidney parenchyma due to retropulsation and mechanical pressure of the stone surface. This increases the risk of macrogematuria and postoperative exacerbation of chronic pyelonephritis. There is often an edema of the parenchyma, which occurs due to a disbalance of a blood microcirculation.

The presence of residual fragments of a stone up to 5 mm is a risk for recurrence of a stone formation. It is also important that in the most cases, a repeated surgical intervention is necessary, which has a significant damaging effect on the kidney parenchyma, which further negatively affects the functional state of the kidney leading to the risk of developing nephrosclerosis.

CONCLUSION

The results of the retrospective analysis demonstrate the relevance of nephrolithiasis and the choice of the lithotripsy method. Nowadays, endoscopic methods rightfully got an important place in the treatment of patients with urolithiasis. Transurethral contact pyelokalikolitotripsy is an effective method due to the fact that it allows the patient to get rid of stones with minimal complications. A successful solution to the shortcomings of the transurethral contact pyelocalycolithotripsy method can be the beginning of a new safe and rational approach to rid patients of concretions of the renal cavity system.

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