

UNFAVORABLE FACTORS OF OUTCOME IN THE TREATMENT OF SUPPURATIVE RENAL INFECTIONS

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FAKTORI NEPOVOLJNOG ISHODA LEČENJA SUPURATIVNIH INFEKCIJA BUBREGA

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ABSTRACT

The purpose of this study was to identify and quantify potential prognostic factors in treatment of suppurative renal infections which influence the outcome. For that purpose a retrospective review of 75 renal suppurative infection patients, at three tertiary Serbian clinics of urology from 1999 through January 2006, was conducted. This series comprised 49 women and 26 men, mean age 56.7 years, range 21–78. Patients were categorized into 3 groups according to the type of suppurative infections: a) unilobular renal or perirenal abscesses, b) pyonephrosis only and c) multiple renal or pyonephrosis infections along with extension on perirenal space. Additional classification was done according to favourable or unfavourable outcome (fatal outcome, unnecessary loss of kidneys or occurrence of recurrent infections which require nephrectomy). The following clinical characteristics were analyzed: demographic data, laboratory findings, comorbidity, infective complications, clinical course, the time of applied drainage/surgical procedures, inadequate diagnosis, refusal/inadequacy of patients for designed interventions and complications of urologic treatment. Leucocytosis in this series of patients showed to be a significant factor of the outcome (OR= 1.011; $p = 0.004$). Extension of infections beyond boundary of kidneys was more common in patients with greater number of predisposing medical problems, and were followed by more common complications of infectious process (OR= 6.249; $p = 0.014$), while comorbidity is independent factor of adverse outcome (OR= 3.167; $p = 0.002$). Pyonephrosis (OR= 0.158; $p = 0.021$) and complications of urologic treatment (OR= 26.364; $p = 0.004$) are significant factors of treatment. The comorbidity (OR= 3.366; $p = 0.001$) is independent factor of failure, and pyonephrosis (OR= 0.127; $p = 0.02$) is favourable independent factor of favourable outcome. Serious complications which are possible during the treatment of these patients bear high risk of failure.

Abbreviations: CI = confidential interval, d/s = drainage/surgical, OR = odds ratio, PC = percutaneous, SIRS = Systemic inflammatory response syndrome.

Key words: outcome assesment, risk factors, kidney, supuration

SAŽETAK

Cilj ove studije je da se identifikuju i kvantifikuju mogući prognostički faktori u tretmanu supurativnih infekcija bubrega koji utiču na ishod lečenja. Retrospektivno su pregledani podaci 75 bolesnika lečenih u tri tercijerne srpske urološke klinike u periodu od 1999 do 2006 godine. U serije je uključeno 49 žena i 26 muškaraca, prosečne starosti 56.7 godina, u rasponu 21–78. Bolesnici su kategorisani prema vrsti patološkog procesa u 3 grupe: a) sa unilokularnim renalnim ili perirenalnim apscesima, b) sa samo pionefrozama i c) sa multipnim renalnim ili pionefrozom infekcijama uz ekstenziju na perirenalni prostor. Dodatna klasifikacija učinjena je prema povoljnom ili nepovoljnom (u slučaju fatalnog ishoda, nepotrebnog gubitka bubrega ili u slučaju pojave recidivne infekcije koja zahteva nefrektomiju) ishodu lečenja. Analizirane su sledeće kliničke karakteristike: demografski podaci, laboratoriski nalazi, komorbiditet, infektivne komplikacije, klinički tok, vreme primene drenažno/hirurških procedura, neadekvatne dijagnoze, odbijanje/nepodesnost bolesnika za planirane intervencije i komplikacije urološkog lečenja. Vrednosti leukocita pokazale su se značajnim faktorom ishoda (OR= 1.011; $p = 0.004$). Ekstenzije infekcija van granica bubrega češća je u bolesnika sa većim brojem predisponirajućih stanja, praćene su češćim komplikacijama infektivnog procesa (OR= 6.249; $p = 0.014$), dok je komorbiditet nezavisni faktor nepovoljnog ishoda (OR= 3.167; $p = 0.002$). Pionefroze (OR= 0.158; $p = 0.021$) i komplikacije urološkog lečenja (OR= 26.364; $p = 0.004$) značajni su faktori lečenja. Komorbiditet (OR= 3.366; $p = 0.001$) je nezavisni faktor neuspeha, a pionefroze (OR= 0.127; $p = 0.020$) povoljan nezavisni faktor ishoda. Ozbiljne komplikacije koje su moguće u toku tretmana ovih bolesnika nose visok rizik neuspeha.

Skraćenice: CI = confidential interval, d/s = drainage/surgical, OR = odds ratio, PC = percutaneous, SIRS = Systemic inflammatory response syndrome.

Ključne reči: procena ishoda, faktori rizika, bubreg, supuracija

INTRODUCTION

The treatment of suppurative entities of kidneys and kidney beds was characterized in previous series of patients by postponing adequate diagnosis, significant morbidity and mortality of untreated patients or after applied aggressive surgical treatment, and sometimes by inadequate therapy procedures which can influence the mortality, at least in some patients (1). It was shown that the mortality was influenced by the type of suppurative entity and applied treatment modality. As a result of improved diagnostics, antibiotic and supportive therapy and application of minimally invasive procedures, in recent patient series very low mortality rate was registered (2). Referring to the above, it seems that the traditional analyses of the treatment outcome from the decreased mortality point of view, although necessary, are not by itself sufficient to es-

timate all most important prognostic modalities, whether favourable or unfavourable. It is well known that the fatal outcome does not have to be directly connected to the unsuccessful therapy, but it could be the result of highly immunocompromised patient (3). In addition, nephrectomy of infected, non-functional kidneys, bears a risk of possible intra and peroperative complications (4, 5) which can be the cause of the final failure. Other possible factors that could influence the outcome are patient's refusal to let the planned interventions be done or his unsuitability for surgical intervention.

In the era of decreased mortality from renal suppurative processes, there are new goals in the treatment: eliminated the infection and preserve existing degree of renal function.

The purpose of this study is to identify and quantify possible prognostic factors in the treatment of suppurative infections of kidneys and kidney beds which can favourably or unfavourably influence the treatment outcome.

PATIENTS AND METHODS

In this study we retrospectively reviewed medical records and radiology files from three tertiary referral Serbian clinics of urology (Institute of Urology and Nephrology Belgrade; Clinic of Urology and Nephrology, the Department of Urology at Kragujevac, and the Clinic of Urology, Nis) from 1999 to 2006. We identified 75 consecutive patients with a final discharge diagnosis of suppurative renal infection.

We analyzed the following variables as potential prognostic factors of treatment outcome: demographic characteristics, laboratory findings, type of pathological process, comorbidity, infectious complications of suppurative entities at beginning of treatment, clinical course, the time of drainage/surgical (d/s) procedure, inadequate diagnosis, refusal i. e. unsuitability of patients for planned surgical interventions and complication of urologic treatment.

Comorbidity was expressed as number of predisposing medical conditions for the beginning of such infections. Clinical course of the disease was defined binary in cases of presence or absence of systematic inflammatory response syndrome (SIRS). Complications of infective process were defined by the appearance of infection extension on serous membranes (peritoneum, pleura), by the beginning of remote infections, or deterioration of renal function which required haemodialysis.

Pathology type one defined unilocular abscess of kidney or its extension on perirenal space or dominant perirenal collection. Pathology type two was defined by the presence of pyonephrosis only. Pathology type three defined pyonephrosis along with extension on perirenal space, bilateral or multiple collections.

Initiation of d/s procedures is illustrated by the day performed on the patient with expressive SIRS. Late d/s procedures are defined by initiation two weeks after the hospitalization in patients with expressive SIRS. Inadequate diagnosis is defined by preoperative diagnosis achieved by radiological methods and differences during exploration or after histopathologic findings after nephrectomies. Patient's refusal to adhere to suggested therapy procedure or inadequacy of the patient to be subjected to nephrectomy or lumbar drainage in general anaesthesia were also taken into account. Complications of urologic treatment are defined by inadequate drainage procedure or approach which directly influence the outcome, by the appearance of serious intra or post-treatment complications or inadequate supporting therapy. Drainage procedures in patients with undisturbed clinical development, with no changes in clinical state, and definitely taken care of with nephrectomies, were not considered as unfavourable outcome.

Unsuccessful final outcome is defined by fatal outcome (during hospitalisation or post-operative period of 12

months) or performed nephrectomy if the kidney is not functional, or if the infection source (calculosis, uroobstruction) is not resolved, i. e. unperformed nephrectomies if it was indicated and which have caused reappearance of abscess and necessity for additional nephrectomy.

Numerical continuous variables were expressed as means \pm SD. Pearson's chi-square test or Fisher's exact test were used to check the association of two categorical variables. Continuous numerical data were analyzed using Student's t-test or Kruskal-Wallis test, depending on the presence of normal or other types of data distribution. Logistic regression model was used for estimation of the importance of particular variables for getting dependent variable (covariate) – final unsuccessful outcome. Multiple logistic regression model (Backward Wald) was used for estimation of the importance of particular variables in univariate logistic regression for control of potential confounding factors and independent variables. The results of logistic regression were expressed in odds ratio (ORs) with 95% confidential interval (CIs). Hypothesis testing was done in two-sided procedure where the level of statistic significance of the null hypothesis was established at $p \leq 0.05$. The SPSS (version 10.0) software package was used for all analyses.

RESULTS

This series comprised of 49 (65.3%) women and 26 (34.7%) men, mean age 56.7 years, ranging 21–78. All the patients were treated with antibiotic therapy. Six of these patients had intrarenal abscesses, two of them had renal/perirenal abscesses, and 15 patients had dominantly perirenal abscesses, which were defined by pathology type one, altogether 23 (30.7%) patients. Thirty (40%) patients had only pyonephrosis, defined by pathology type two. Twenty two (29.3%) patients had pyonephrosis or multiple renal abscesses with perirenal extensions and/or serous membranes, which were defined by pathology type three. There were three malignancies as underlying cause of suppurative collections, one renal cell adenocarcinoma, one papillary cystadenoma of the kidney, and in one patient transitional cell carcinoma of ureter with consecutive ureteropyonephrosis. Seven (9.3%) of these patients had emphysematous infections.

Comorbid disorders were as following: diabetes mellitus (in 24% patients), urolithiasis (63.3%), urinary obstruction (68%), renal tuberculosis (4%), 4% chronic pyelonephritis (4%), chronic renal failure (17.3%), malignancy or suspected malignancy (17.3%), nosocomial origin of these infections (13.3%), while in 4% of the patients no risk factors were discovered.

Decreased haemoglobin, leucocytosis, or elevation of serum creatinine levels were common laboratory findings in patients. The mean leukocyte count in all patients was $14.3 \pm 7.5 \times 10^9/L$ (range 4.5 to $38 \times 10^9/L$), while leucocytosis of particular pathological processes (14.3 ± 7.7 ; vs. 11 ± 4.1 ; vs. 18.6 ± 8.9 ; $p = 0.001$, respectively), as well as of controlled outcomes were significantly different (12.8 ± 6 vs. 19.7 ± 10 ; $p = 0.004$). The mean value

of haemoglobin was 101.3 ± 17.5 g/L (range from 67 to 141 g/L), the mean serum creatinine level was 233 ± 280 μ mol/L (range 60 to 1568 μ mol/L).

Nine (12%) patients had significant complications of infective process at the beginning of treatment, out of whom two (22.2%) acute renal insufficiency treated by haemodialysis, one (11.1%) deep venous thrombosis of thigh, one (11.1%) purulent meningitis, one (11.1%) empyema of pleura and 4 (44.4%) peritonitis.

Clinical course in 49 (65.3%) patients showed the properties of distinct SIRS.

Patients in observed pathological groups did not differ as to their age, gender, haemoglobin values, creatinine, clinical disease course, initiation of d/s procedures in the states of distinct SIRS, inadequate preoperative diagnosis, refusal or unsuitability for the planned surgical treatment, complications of urological treatment, or in late drainage surgical procedures in the state of distinct SIRS (table 1). The number of comorbid conditions and infective complications of purulent processes was considerably higher in patients with pathology type three than in other types, representing less severe infections ($p = 0.01$, $p = 0.003$, respectively, table 1).

Table 1. Univariate analyses of the association of selected factors with fatal and other unfavourable outcome, according to pathological process (n=75) †.

Variable	Pathology type 1‡ n=23 (30.7%)	Pathology type 2‡ n=30 (40%)	Pathology type 3‡ n=22 (29.3%)	p value
Age (years)	54.9 ± 14.4	58.3 ± 11.9	56.2 ± 15.1	0.666
Sex (male/female)	7/16	11/19	8/14	0.877
WBC ($\times 10^9$ /L)	14.3 ± 7.7	11 ± 4.1	18.6 ± 8.9	0.001
Hgb (g/L)	101 ± 17.4	104 ± 18	97.4 ± 16.8	0.362
Creatinine (μ mol/L)	155.1 ± 158.2	251.4 ± 314.6	289.3 ± 321.7	0.252
Comorbidity (No.)	2.1 ± 1.3	2.6 ± 0.9	3.2 ± 1.0	0.01
Complication of infective process (no/yes)	22/1	29/1	15/7	0.003
Clinical course SIRS no/yes	9/14	11/19	5/17	0.447
S/PCD/SD/PCN/other§	1/9/8/0/1	7/0/0/10/0	3/9/7/2/1	n. a.*
Initiation of d/s procedures (days)	10.9 ± 7.8	7.5 ± 9.5	9.7 ± 5.8	0.48
Nephrectomy I/II	5/1	13/12	7/9	<0.001
Inadequate Dg (no/yes)	19/4	28/2	18/4	0.381
Refusal/inadequacy (no/yes)	21/2	28/2	19/3	0.689
Complication of urologic treatment (no/yes)	17/6	25/5	15/7	0.498
Late d/s procedures (no/yes)	13/1	16/2	13/4	0.383
Fatal/other¶	3/4	0/2	4/3	n. a.*

† Values given as mean ± SD or No of subjects, ‡see the text for pathology types definitions, §Sondage, PC drainage, Surgical drainage, PC nephrostomy, other, *not applicable, ¶ relapse, exaggerated loss of kidney.

In patients with pathology type one, we performed one retrograde stent placement, 9 percutaneous (PC) drainages out of which 7 were curative, 8 surgical drainages, all of them curative, one partial nephrectomy, 5 primary and one secondary nephrectomy. Drainage procedures in the states of distinct SIRS were performed on an average 10.9 ± 7.8 days, the range first to 28th day of hospitalization. Three patients of this group suffered the fatal outcome out of which one was the first day after PC drainage, and the other two in the period of 3 to 6 months after discharge. Two affected kidneys dealt with nephrectomy were not afunctional and in two patients after treating infection with drainage procedures, there appeared infection recurrences and they were cured with nephrectomy.

In patients with pathology type two, 7 retrograde stent placements, 10 PC nephrostomies, 13 primary nephrectomies and 12 secondary nephrectomies were carried out. In three patients after drainage procedures we did conserving interventions (1 ureterolithotripsy, 1 ureterocele incision, 1 ureterolithotomy), while two patients refused further treatment after drainage procedures and infection tranquilization. Initiation of drainage procedures was

performed 7.5 ± 9.5 days, range the first to 41st day of hospitalization. There were no fatal outcomes in this group of patients, and in two patients we performed nephrectomy in two kidneys which were not afunctional. In patients with pathology type three 3 retrograde stent placements, 9 PC drainages, two PC nephrostomies, laparotomy drainage in one, 7 primary and 9 secondary nephrectomies were carried out. Initiation of drainage procedures was performed 9.7 ± 5.8 days, the range being the first to 20th day of hospitalization. Four patients from this group suffered fatal outcomes, three of them within hospitalization and one 2 months after the discharge, while three patients had recurrent abscesses where nephrectomies were done.

Frequency of fatal outcome in patients with pyonephrosis only was significantly lower compared to patients with complex suppurations ($p = 0.027$), while comparison in other groups were not considerably different (pathology type 1 vs. pathology type 2 $p = 0.076$; pathology type 1 vs. pathology type 3 $p = 0.7$). Frequency of other complications in observed groups did not differ (pathology type 1 vs. pathology type 2 $p = 0.384$; pathology

type 1 vs. pathology type 3 $p = 1$; pathology type 2 vs. pathology type 3 $p = 0.267$).

Nephrectomy rate in the treatment of patients with pathology type 2 and pathology type 3 was significantly higher in comparison with pathology type 1 ($\chi^2 = 17.57$, $p = 0.000$; $\chi^2 = 9.78$, $p = 0.002$), while it did not differ in these two groups ($\chi^2 = 0.85$, $p = 0.355$).

In 7 (14.3%) patients with the clinical state of distinct SIRS, late d/s procedures were carried out after on average 21.7 ± 8.8 days, range 16–41 days of hospitalization.

Five (6.7%) patients refused the suggested intervention or were otherwise unsuitable for the planned surgery, out of whom two died after the discharge, and in three patients there were no late consequences in the period of observation.

In 6 (8%) patients we recorded considerable complications of urologic treatment. In one female patient we could not achieve adequate pyelonephrosis drainage by placing retrograde stent. One female patient treated by laparotomy drainage developed multiple organ failure with mortal outcome. In one patient the bleeding gastric ulcer developed after the PC abscess drainage and gastrotomy did not prevent bleeding, so we performed the total gastrectomy with difficult recovery of the patient and the planned nephrectomy was not performed, the outcome being fatal two months after the discharge. One female patient of generally bad condition had a fatal outcome after the PC drainage of the abscess, but the supporting therapy was considered inadequate. In one patient the presence of drain after nephrectomy caused

stercoral fistula on the 18th postoperative day, which was resolved by preternatural anus, but with final fatal outcome on 54th day of hospitalization. In one female patient nephrectomy was carried out in pieces with significant intraoperative bleeding, but with favourable final outcome.

Patients who survived after hospitalization ($n = 71$) were observed 32.9 ± 17.7 months in average, the range 2 to 81 months, and totally survived patients ($n = 68$) were observed in average 34.2 ± 16.9 months, range 10 to 81 months.

Unfavourable final outcome was marked in 16 (21.3%) patients, out of which 7 (43.75%) were fatal, 4 (25%) because of losing kidneys which were not afunctional, and 5 (31.25%) because of persisting infection source with recurrent abscesses and additional nephrectomies.

Univariate regression analyses of the treatment final outcome ($n=75$) showed that comorbidity (OR= 3.167; 95% CI= [1.688; 5.941]; $p = 0.002$), complications of infective processes (OR= 6.249; 95% CI= [1.443; 27.056]; $p = 0.014$), pathology type 2 (OR= 0.158; 95% CI= [0.033; 0.758]; $p = 0.021$), complications of urologic treatment (OR= 26.364; 95% CI= 2.802; 248.063]; $p = 0.004$) and leucocytosis (OR= 1.011; 95% CI= [1.004; 1,019]; $p = 0.004$) are relevant factors of the treatment failure (table 2). Multiple regression analyses showed that only comorbidity (OR= 3.366; 95% CI= [1.679; 6.747]; $p = 0.001$) and pathology type 2 (OR= 0.127; 95% CI= [0.022; 0.725]; $p = 0.02$) are independent factors which influence the failure and success of the treatment final outcome (table 3).

Table 2. Univariate binary regression analysis, according to final treatment outcome ($n=75$) †.

Variable	Group 0 (success)	Group 1 (failure)	OR (95% CI)	p value
Age (years)	55.9 ± 14.1	59.3 ± 11.2	1.02 (0.976–1.064)	0.380
Sex (male/female)	20/39	6/10	0.855 (0.272–2.69)	0.788
WBC ($\times 10^9/L$)	12.8 ± 6	19.7 ± 10	1.011 (1.004–1.019)	0.004
Hgb (g/L)	102.6 ± 17.4	96.7 ± 17.7	0.98 (0.947–1.014)	0.236
Creatinine ($\mu\text{mol/L}$)	238.7 ± 307.5	211.8 ± 146.7	1.00 (0.997–1.002)	0.732
Comorbidity (No)	2.3 ± 1	3.7 ± 1.1	3.167 (1.688–5.941)	0.002
Complication of infective process (no/yes)	53/11	4/5	6.249 (1.443–27.056)	0.014
Clinical course SIRS (no/yes)	22/37	3/13	2.577 (0.66–10.057)	0.173
Pathology type 1‡ (no/yes)	43/16	9/7	2.09 (0.667–6.551)	0.206
Pathology type 2‡ (no/yes)	31/28	14/2	0.158 (0.033–0.758)	0.021
Pathology type 3‡ (no/yes)	44/15	9/7	2.281 (0.723–7.193)	0.159
Inadequate Dg (no/yes)	50/9	15/1	0.37 (0.043–3.164)	0.364
Initiation of d/s procedures (days)	10 ± 8.7	7.2 ± 4.5	0.946 (0.856–1.047)	0.284
Refusal/inadequacy (no/yes)	56/3	14/2	2.667 (0.406–17.521)	0.307
Complications of urologic treatment (no/yes)	58/1	11/5	26.364 (2.802–248.063)	0.004

† Values given as mean ± SD or number of subjects, ‡see the text for pathology types definitions.

Table 3. Multiple logistic regression of final outcome.

Variable	OR (95% CI)	p value
Comorbidity	3.353 (1.673–6.724)	0.001
Pathology type 2	0.128 (0.022–0.737)	0.021

DISCUSSION

Results of this study show that a number of factors influenced the outcome of treated suppurative infections of kidneys and kidney beds.

Patients with different pathological processes did not differ as to the demographic characteristics, nor did the patient's age influence the treatment outcome. These findings are opposite to the findings of Yen et al. (1) which found that the patient's age was a predictor of higher possibility of mortality. However, our results are in agreement with findings of Siegel et al. (6) who found that the age did not influence the outcome. Values of leucocytes in this series of patients significantly differed in patients with certain types of suppuration and showed to be a relevant indicator of poor treatment outcome ($p = 0.004$), but with the magnitude of little clinically value. These findings are in compliance with the findings of Thorley et al. (7) which found that leucocytosis higher than $25,000/\mu\text{L}$ was associated with bad prognosis. Creatinine values did not differ in our observed pathological groups, nor influenced the treatment outcome in this study, which is converse to the findings of Yen et al. (1) and Thorley et al. (7), that increased blood urea nitrogen is combined with bad prognosis.

Mortality of suppurative entities of kidneys and kidney beds is strongly influenced by the type of infection and applied treatment mode. The reported mortality of patients with pyonephrosis in literature is lower (2.7% to 7%) compared to the other types of suppuration and causes are similar to present abscesses (5, 8, 9). In our study there were no fatal outcomes in the treatment of pyonephrosis and frequency of fatal outcome in patients with pyonephrosis only was significantly lower compared to patients with complex suppurations. It was illustrated that the presence of pyonephrosis, as a type of suppurative entity, is a favourable independent prognostic factor of the illness outcome for about 7–8 times. These findings can partially be explained by the fact that pyonephrosis is a relatively common problem in the urologic practice, with higher frequency compared to other types of suppurative entities, as illustrated in our series, making 1.8% of all urologic admissions (5), urologist's familiarity in their treatment and more frequent nephrectomies in the definite treatment.

The importance of comorbidity in the outcome of the patient with suppurative infections was reported in several peer-reviewed studies. Low mortality in the series of Capitan et al. (10) (1.5%), could be explained by the low incidence of comorbid condition in study sample. Fatal outcome sometimes does not have to be directly connected to the failure of the therapy, but can be the result of the strong patient's immunodeficiency (3). The

causes of mortality are usually divided into those caused by sepsis or septic complications, those caused by comorbidity states, i. e. causes not related to d/s procedures or septic sequels (11) deteriorated state and decompensation of underlying illnesses (10, 12). Yet, opposite to our work, the previous studies did not precisely quantify the influence of comorbidity on the outcome. Our study proved that infection extensions beyond kidney boundaries were more common in patients with greater number of predisposing medical problems. It is also illustrated that every additional associated pathological problem i. e. illness increases the risk for the unfavourable outcome for about 3.3 times.

The literature has shown the outcome of patients who had refused to be submitted to the suggested surgery. In the series of Siegel et al. (6) 5.7% (3 out of 52) patients refused the suggested treatment, but were treated only by antibiotic therapy and all of them died from septic complications. Two of 47 patients with diagnosis in the series of Salvatore et al. (13) were not operated and died from perinephritic abscesses. When authors analyzed their series of patients and their strategy, they particularly paid attention on the patient's capability to tolerate nephrectomy. In one large-scale series of patients with intraabdominal and perinephritic abscesses (335 patients), authors applied palliation of drainage procedures to relieve the patient from his discomfort and improve his general condition in case he or she was not capable for any kind of surgical treatment because of expected short period of survival (11). Refusal or unsuitability of patients for the planned surgical intervention in this series did not differ in observed groups of patients for certain types of suppuration nor was the factor that caused the final outcome of the treatment in the observed period. These results enforce the question whether the suggested interventions (nephrectomies) were adequate, i. e. whether the planned nephrectomies were necessary in afunctional kidneys. The possible recurrent infections in some patients and the fact that in others they were not followed by significant morbidity, illustrates that in some they are strongly indicated and in the others are not obligatory. Drainage in two patients inadequate for an open surgery and in one patient who at first demanded PC drainage, and then accepted two open drainages lasted on average 47.1 days in the range of 25 to 69 days, two of which had a favourable outcome, while one patient had a fatal outcome after three months of hospitalization, which shows that prolonged drainages have their value in the treatment of these infections with possible favourable outcome.

In this study there were no possibility for the analysis of certain inadequate procedures of urologic treatment, because this requires larger sample, but it differentiates initiation and late d/s procedures in the states of distinct SIRS as a special variableness, which did not show to be the causative factor of failed treatment, which is in contrast to previously published papers. The time of making an adequate diagnosis is in positive correlation with mortality rate (2). Improved antimicrobial

and other supporting therapies, necessity for an early aggressive therapy, are significant outcome factors in other studies (1, 3, 10, 12, 14, 15). Aggressive surgical approach in patients with septic shock of renal source improves the outcome (16) in comparison with patients treated conservatively (17). Findings of this study can at least partially be explained by chronic character of infections and possibility to treat with adequate antibiotic therapy with postponed d/s procedures at least in some patients.

Serious complications, illustrated in this study, which influence the poor outcome, were recorded in other series of patients as well. Failure of PC drainage with fatal outcome as a consequence of sepsis was illustrated by Lambiase et al (11) in two of their patients, which can be said for one female patient from this series who died 24h after PC drainage. Inadequate estimation of appropriate surgical treatment can cause complications with multiple organ failure (1, 12). In our series one patient died in the first 24h after laparotomic drainage, and in the series Meng et al. (12) on the 16th postoperative day from sepsis with renal and hepatic failure. Significant gastrointestinal bleeding after PC drainage of perinephritic abscesses was illustrated in the series of Sacke et al. (18) which caused death 3½ weeks after the drainage, and in this series one female patient was submitted to total gastrectomy because of strong gastrointestinal bleeding, but she died two months later. In the series of Salvatierra et al. (13) in 30% (12 out of 40) dead, decreased renal function contributed to the cause of the death, which can be applied to one patient from this series, in whom the fundamental disease, cervical cancer, was treated by radiotherapy and chemotherapy.

Nephrectomies of infected nonfunctioning kidneys are almost always difficult because of strong fibrotic changes between Gerota fascia and renal parenchyma, especially if they were preceded by previous surgeries. Intraoperative complications of nephrectomies in suppurative entities are common, on the left side injuries of spleen and pancreas being possible (19) and on the right side injuries of duodenum (4), caval vein (4, 5) and liver laceration, as well as numerous minor complications as opened pleura, peritoneum or both (4). There are possibilities on both sides for the injuries of colon (4, 5). In this study there were no intraoperative technical complications which caused death in 47 performed nephrectomies, while minor complications were not considered in the outcome. Serious intraoperative complications, injuries of caval vein were recorded in other series in 2% to 2.6% of nephrectomies (4, 5). Other shown serious intraoperative complications were respiratory insufficiency (5), acute renal insufficiency (5), cardiac arrest (4). One (2.1%) nephrectomy was performed as atypical, in parts. Intraoperative mortality in other series was recorded per one patient (4, 5). Perioperative mortality in this series was recorded in two (4.2%) patients, on the ninth and 54th post-operative day. Perioperative mortality in other series of patients with nephrectomies done, ranges 0.3% to 3.1%, as a consequence of cancer dissemination, reopera-

tions, myocardial infarct, ulcer perforation, respiratory insufficiency, cerebrovascular incidents (20), pulmonary embolism (21). Intestinal fistulas in other series of patients were recorded in 1.7% to 3% nephrectomies (4, 5). In one patient (2.1%) from this series stercoral fistula developed on the 18th postoperative day which is considered to be the result of necrosis and compression by the drain, and it was treated by peternatural anus. This study has shown that serious complications of urological treatment bear a high risk of the treatment failure which is about 26 times (OR, 26.3; $p = 0.004$).

In this study mortality was recorded during the interval of 12 months and its rate was 9.3% (7 out of 75). Other authors also report mortality of suppurative infections of kidneys and kidney beds, or abscesses of other locations in the interval of 10 to 18 months, considering this interval as adequate to discover unsuspected complications of previous infections, or as a period of deaths as consequence of basic diseases (11, 13, 22).

It was occasionally difficult to separate the deaths related to septic complications from those that were the culmination of numerous and complex associated medical problems (11).

Nephron salvage in suppurative infections of kidneys defined as any therapy that does not excise viable renal tissue (6). Nephrectomies without trying drainage procedures in the states of preserved kidney function were considered as unfavourable outcome in this series of patients. Nephron salvage in the series of patients with pyonephrosis, initially treated with PC nephrostomies was in the range 12.2% to 83.1% (5, 8, 23), and in the series of patients with perinephric abscesses the range was 14.9% to 100% (2, 3, 13, 22, 24). In this series of patients who survived or did not refuse suggested intervention, or it was not performed because of bad general condition, nephron salvage was 30.2% (19 out of 63). Certainly, the concept of pyonephrosis, which includes infected urine in obstructed collecting system, contains a wide range of kidney functionality, which is not reported in the papers and which explains great differences in nephron salvages in the presented series. Namely, pyonephrotic suppurations where the salvage of renal unit was achieved, were not afunctional in this series of patients.

In conclusion, extension of infections beyond boundary of kidneys was more common in patients with greater number of underlying medical conditions because the comorbidity represent an independent factor of adverse outcome. On the other hand, the presence of isolated pyonephrosis, as a distinct suppurative entity, is an independent factor of favourable outcome. Leucocytosis in this series of patients showed to be a slightly but significantly associated with treatment failure. Refusal or unsuitability of patients for planned surgical intervention, initiation and late d/s procedures in the states of distinct SIRS, did not show to be a causative factor of unsuccessful treatment. Serious complications which are possible in course of treatment these patients bear high risk of treatment failure.

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