ORIGINAL ARTICLE

Infected hydronephrosis: can we reduce patient suffering and costs?

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Abstract

Objective: To investigate the correlation among clinical parameters, risk factors, outcomes and costs in the context of patients with infected hydronephrosis.

Methods: This retrospective, multi-centric study was conducted in three Romanian academic urology departments, and comprised data of patients with infected hydronephrosis treated between July 2013 and July 2014. Based on per-patient hospitalisation costs, the participants were divided into three groups: group A: cost less than 500 euros), group B: between 500 and 1,000 euros, and group C: over 1,000 euros). Differences between clinical parameters, comorbidities, type of procedure, admission to intensive care unit, length of hospital stay and costs were analysed.

Results: Of the 175 patients, 49(28%) were in group A, 95(54.3%) in group B and 31(17.7%) in group C. The relevant parameters influencing outcomes and costs were age (p=0.001), neoplasical aetiology (p=0.001), leukocytosis (p=0.001), renal insufficiency (p=0.001), and moment of the intervention (p=0.005). Diabetes did not influence the costs (p=0.36). JJ stent insertion was tolerated at least the same as percutaneous nephrostomy, and with the same efficiency.

Conclusion: In order to avoid patient suffering and to reduce costs linked to the treatment of infected hydronephrosis, the patient-general practitioner-specialist collaboration is of the utmost importance. Symptoms, signs, paraclinical features and empirical use of antibiotics may all lead to a delay in proper management, thus making the hospitalisation longer and the costs significantly higher.

Keywords: Costs, Hydronephrosis, Infection, Sepsis. (JPMA 66: 1372; 2016)

Introduction

Infected hydronephrosis is a urological emergency which, in addition to a rapid and precise diagnosis, requires the drainage of the pyelocalyceal system in a specialised unit. The diagnosis in these cases is based upon the following: lumbalgia associated with fever, chills, leukocytosis or leucopenia, tachycardia and tachypnoea.[1]

Based on the fact that this is a life-threatening pathology, we felt it useful to evaluate the consequences of an empirical anti-biotioc therapy (ABT) (recommended by the general practitioner or as self-medication) upon the evolution of the disease; whether the delay of the renal drainage had any consequences for the outcomes, the length of stay and the treatment costs; whether the insertion of a double-J (JJ) stent was less efficient and expensive than the percutaneous nephrostomy (PNS); and whether the comorbidities were a factor that influenced patients' evolution regardless of the drainage method used.

We consider this debate important due to the fact that in 25% of cases the aetiology of sepsis is represented by infected hydronephrosis[2] and the urosepsis mortality occupies second place in the septic shock hierarchy, after the intra-abdominal infections, with a real high rate of 20 to 42%.[3,4]

The current study was planned to investigate the correlation among clinical parameters, risk factors, outcomes and costs in the context of patients with infected hydronephrosis.

Patients and Methods

This multi-centric, retrospective study was conducted in three Romanian academic urology departments from Parhon Clinic Hospital, Targu Mures County Hospital and "Prof. Dr. Th. Burghele" Clinical Hospital and comprised data of patients with infected hydronephrosis treated between July 1, 2013, and July 1, 2014. The diagnosis was based on clinical evidence of the systemic inflammatory response syndrome (SIRS) and ultrasonographic evidence of hydronephrosis. Clinical data, comorbidities and hydronephrosis aetiology were analysed. The outcomes measured included type of procedure, admission to intensive care unit (ICU), length of hospital stay and hospitalisation costs.

Based on the hospitalisation costs (number of days, drugs and specific materials) the data of patients was divided

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into three groups: group A: cost/patient less than 500 euros); group B: cost/patient between 500 and 1,000 euros, and group C: cost/patient over 1,000 euros. The monetary figures mentioned above were spent on the treatment of the acute infected hydronephrosis episode. Many of the patients were discharged after being stabilised and readmitted at a later date in order to ascertain the cause of the infected hydronephrosis.

All of the patients benefited from a renal drainage through PNS or JJ insertion. JJ stent drainage was first used, and PNS insertion was employed from the beginning in cases with hydronephrosis due to urogenital cancer invasion or JJ insertion failure. The study was approved by the ethical review boards of the participant institutions.

Statistical analysis was performed using chi-Square test and student's t-test (two samples assuming unequal variances) in Microsoft Office Excel 2010. P<0.05 was considered statistically significant.

Results

Of the 175 patients, there were 49(28%) in group A, 95(54.3%) in group B and 31(17.7%) in group C. Besides, 35(71.42%) patients had fever in group A compared to 60(63.15%) in group B and 19(61.29%) in group C. (Table-1). Fever had no influence upon the costs (p=0.43), nor did diabetes (p=0.36).

Age was an element which influenced the costs (Table-2). The mean age was 59.02±17.95 years in group A, 57.64±19.01 years in group B and 54.90±17.49 years in group C. The total antibiotic drug cost was 26.92 euros per patients in group A compared with 67.60 euros in group B (p=0.0001) and 94.82 euros in group C (p=0.02).

The mean time spent between hospital admission and intervention was 9.1±3.64 hours in group A, 15.75±8.18 hours (p=0.027) in group B, and 39.25±12.03 hours (p=0.008) in group C. The duration of hospitalisation was correlated with the final costs of hospitalisation and the moment of drainage. Another element that influenced the patient's evolution was the moment of drainage (p<0.05). In cases of favourable evolution, the drainage was performed in a mean time of 5.88±2.71 hours from the admission versus 7.44±3.62 hours in cases of patients with unfavourable evolution (p=0.005).

The presence of renal insufficiency also influenced the costs and the duration of hospitalisation. In group A, 16(32.6%) patients had renal insufficiency, while in group B and C there were 52(54.7%) and 24(77.41%) patients with azotaemia (p=0.003).

Moreover, there were 30(61.22%) patients with leukocytosis in group A, 58(61.05%) in group B and 30(96.7%) in group C (p=0.048).

The mean hospitalisation duration for group A patients

Table-1: Baseline characteristics.

		Group A			Group B			Group C		
Number of patients		49			95			31		
Age		59.02±17.95			57.64±19.01	A vs. B p=0.01		54.90±17.49	B vs. C p=0.23	
Gender Male : Female		14:35	1:2.5		30:65	1:2.16		9:22	1:2.44	
Symptoms	Fever	35 (71.42%)			60 (63.15%)			19 (61.29%)		
	Chills	33 (67.34%)			56 (58.94%)			19 (61.29%)		
	Pain only	14 (28.57%)			25 (26.31%)			7 (22.58%)		
US modified echogenity		15 (30.61%)			24 (25.26%)			11 (35.48%)		
Leucocytosis		30 (61.22%)			58 (61.05%)			30 (96.70%)	p=0.048 χ^2= 9.345	
Renal insufficiency		16 (32.65%)			52 (54.73%)			24 (77.41%)	p=0.03 χ^2=15.651	
Etiology	Lithiasis	71.42%			71.57%			58.06%		
	Pregnancy	16.32%			4.21%			6.45%		
	UPJO*	8.16%			4.21%			9.67%		
	Urogenital cancers	2.05%			8.42%			12.90%		
	Ureteral stenosis	2.05%			11.59%			12.90%		
Comorbidities	Diabetes	9 (18.36%)			20 (21.05%)			3 (9.67%)		
	Obesity	9 (18.36%)			14 (14.73%)			2 (6.45%)		
ATB before admission		Total	Self	GP	Total	Self	GP	Total	Self	GP
		12 (24.48%)	7	5	52 (54.73%)	36	16	21 (67.74%)	10	11
Moment of drainage (hours)		9.1			15.75	A vs. B p=0.027		39.25	B vs. C p=0.008	

*UPJO: ureteropelvic junction obstruction
ATB: Antibiotics
GP: General practitioner.

Table-2: Evolution, stay and costs.

	Group A			Group B			Group C		
Evolution	Sim*	Com**	Death	Sim*	Com**	Death	Sim*	Com**	Death
	43	5	1	59	35	1	17	12	2
Hospital stay		4.25 days		6.19 days		A vs. B p=0.001	12.03 days		B vs. C p=0.0001
	JJ	PNS	p value	JJ	PNS	p value	JJ	PNS	p value
	3.66	4.43	p=0.12	6.17	6.48	p=0.09	11.70	12.63	p=0.9
Total cost (euro)	352.77	353.47	NS	606.39	634.94	NS	1254.23	1273.34	p=0.45
ATB cost (euro)		118.48		297.47		A vs B p=0.001	417.23		B vs C p=0.02

*Sim - evolution simple without hemodinamic instability
** Com - evolution complicated with hemodinamic instability and admission to intensive care unit
ATB: Antibiotics
PNS: percutaneous nephrostomy
NS: Not significant.

Table-3: Risk factors for complicated evolution.

	*Sim	** Com	
Total patients	119	56	
Average age (years)	59.86	62.78	p=0.001
Neoplastic etiology	3	9	p=0.001
Renal insufficiency	42.01%	76.78%	p=0.001
Moment of the intervention (hours)	5.88	17.44	p=0.005
Leukocytosis	58.82%	94.64%	p=0.001
Drainage method (JJ stent)	72.26%	27.74%	p=0.02
Drainage method (PNS)	59.61%	40.39%	p=0.06

*Sim - evolution simple without haemodynamic instability
** Com - evolution complicated with haemodynamic instability and admission to intensive care unit
PNS: Percutaneous nephrostomy.

was 4.25±1.32 days compared with 6.19±1.92 days (p=0.001) for group B and 12.03±2.32 days (p=0.001) for group C.

Mean hospitalisation cost was 600.53±85.11 euros for JJ stent and 680.11±115.25 euros for PNS. Patients with a favourable evolution had a mean age of 59.86±16.24 years, while for those with an unfavourable evolution this figure stood at 62.78±17.69 years. A negative prognostic factor was the recurrence of lithiasis and the neoplasical etiology (p=0.001) (Table-3).

Patients with favourable evolution had the intervention performed, on average, 5.88±2.71 hours following hospital admission compared to those with unfavourable evolution cases who underwent the procedure, on average, after 7.44±3.62 hours (p=0.005). Besides, 70(58.82%) patients in the group with favourable evolution presented with leukocytosis compared with 53(94.64%) in the unfavourable evolution group (p=0.001).

Furthermore, 36(20.6%) patients presented 10-30 days after the debut of symptoms; 21(58.3%) of them had an unfavourable evolution. Following the occurrence of symptoms, the average time that passed before patients with unfavourable evolution were submitted to the urologist was 88.12 hours, compared with 74.01 hours in patients with favourable evolution (p=0.05).

In group A, patients with PNS required a shorter hospitalisation period than those with JJ (3.66 versus 4.43 days) (p=0.12). The cost was 352.77 euros for the PNS group and 353.77 for the JJ stent group. There were 9(18.36%) diabetic and 9(19.36%) obese patients (body mass index [BMI] > 30 kg/m^2), 6(66.7%) of whom were obese diabetics. The cost was 352.77 Euros for the diabetic patients compared with 353.47 Euros for others.

In group B, patients with JJ insertion had a hospital stay of 6.17 days compared to 6.48 days for those with PNS (p=0.09). Hospitalisation costs were 606.30 euros for patients with JJ catheterisation compared with 634.94 euros for the PNS group. Moreover, there were 20(21.05%) diabetics and 14(14.73%) obese patients in the group. Among the diabetics, 12(60%) had a good evolution, with no significant difference from the rest of the cases (p=0.82).

In group C, the patients with JJ insertion required a hospitalisation stay of 11.7 days compared with 12.63 days in the PNS group (p=0.9). The hospitalisation costs were 1254.23 euros for the JJ group compared with 1273.34 euros for the PNS group (p=0.45).

The main method used to diagnose infected hydronephrosis was abdominal ultrasound. The method's sensitivity was 100%. Of the total, a modified echogenity (firmly indicating infected urine) was found in 42(24%) cases. Of them, the patient's urine presented evident signs of infection at the moment of the drainage in

36(85.7%) cases. Infection was confirmed in 26(61.9%) cases. Among the remaining 133(76%) patients without modified echogenicity, infection was confirmed in 61(45.86%) cases (p=0.069). Moreover, positive urine cultures were recorded in 157(89.71%) patients.

There were 23(13.1%) patients who had elevated C-reactive protein (CRP) and good disease evolution, compared with 13(7.4%) who had elevated CRP and less favourable evolution (p=0.61).

Moreover, there were 12(6.8%) pregnant women among the participants, with (mean age of 28.25+6.151 years (range: 17-42 years), and 23-35 weeks in evolution. All of the patients presented with lumbar pain, while 10(83.3%) had fever and 9(75%) had leukocytosis. In 8(66.7%) cases, a JJ stent was inserted, while the PNS option was selected for the remaining cases. Immediate catheterisation in this group (9(75%) patients within first 6 hours of hospitalisation and 3 patients within 20 hours of admission) led to relatively low costs. Moreover, 9(75%) of these patients were included in group A, 2(16.7%) in group B and only 1(8.3%) in group C. We recorded no deaths among this group. In 1(8.3%) case, the decision to initiate the delivery was taken due to the toxico-septical complications, although the foetus had no vital signs. The mean hospital stay among the group was 4.45 days and costs were 427.82 euros.

Discussions

It is obvious that infected hydronephrosis is one of the major emergencies in urological practice. It requires rapid drainage and efficient anti-biotherapy in order to reduce the patient's suffering, the costs of the hospitalisation, and to shorten the length of hospitalisation. Although these facts are very well known, in daily practice we are confronted frequently with situations that delay the moment of treatment and increase the costs. Urosepsis constitutes 25% of total sepsis — the main cause of the majority of situations resulting from stone ureteral obstruction. In our study, we found that urolithiasis was responsible for obstruction in 68.57% of cases.

The diagnosis in cases of ureterohydronephrosis is immediate and non-invasive, as ultrasonography has a specificity of 100%. Nowadays, the use of ultrasound is widespread, with many general practitioners using the method in daily practice. In cases of hydronephrosis, a well-trained uroradiologist with a last generation ultrasound machine is capable of differentiating the modified echogenity from the normal one. Indeed, this step is crucial in the diagnosis. In our study, the percentage of the patients with modified echogenity was significantly higher than for the group with no changes (92.6% versus 64.1%; p=0.03).

In our study, 93.71% of the cases cited lumbar pain as the leading symptom, and the factor which had made them present for a consultation; only 65.71% presented with fever and 63.42% presented with chills as associated symptoms. The empirical anti-biotherapy of a urinary tract infection associated with lumbar pain in the absence of fever and chills, led to diagnostic difficulties from the point of view of a urologist on duty at the emergency department.

Self-medication and general abuse of antibiotics over recent years have given rise to important problems in public health, while these occurrences are also responsible for increasing anti-biotic resistance. In many of the cases, patients had begun the anti-biotherapy prior to a specialist consultation, only based upon recommendations from friends or family. In many countries, local policy facilitates the use of antibiotics, as there is no requirement for medical prescription. In well-developed countries, self-medication is between 8-13%, while in poorly developed countries it can reach 73%.[5] There are also cases in which a specialist prescribes an antibiotic with an insufficient dosage or for a reduced period.[6]

An uncomplicated clinical picture can create difficulties for the urologist and make him or her reluctant to select an invasive drainage gesture. In the absence of some "mathematical" criteria and with the patient pressurising the specialist to select a non-invasive treatment, sometimes the decision is extremely difficult for the urologist. An old patient, with a history of lithiasis, has a high risk of developing urosepsis,[7] with age representing a negative prognostic factor. In our study, age was a factor, and also had an impact upon costs.

Laboratory findings are very important in the evolution of patients with infected hydronephrosis. The presence of renal insufficiency and leukocytosis had a negative influence on the evolution. Surprisingly, diabetes had no negative impact upon evolution, with our data similar to that presented in the literature.[7] Furthermore, 33(18.85%) patients suffering from diabetes did not necessitate additional costs compared with non-diabetic patients.

Patients and general practitioners need to understand that the most important moment in the management of these patients is the renal drainage (JJ stent or PNS); otherwise, the mortality increases alarmingly.[8] A key factor in the evolution of these patients is the moment of drainage; the sooner the drainage occurs, the better. Indeed, rapid drainage leads to a more favourable

evolution, and lower costs.[9]

Concerning the modality of the drainage, this is influenced by the aetiology of hydronephrosis. If in the case of neoplasic obstruction, nephrostomy is the choice, while in lithiasis cases we can choose between PNS and JJ insertion. The choice is far from easy, as there is no consensus in this direction.[10] Pearle et al. did not demonstrate the higher efficiency of one method or the other,[11] although Mokhmalji et al. suggested that PNS is superior.[12] In our study, JJ insertion was better tolerated than PNS with the same efficacy.

Despite the fact that urolithiasis is a multidisciplinary pathology, general practitioners play the most essential role in simplifying and optimising the management of lithiasis.[13,14] It is obvious that in this pathology the general practitioner has a key role, underlined by the duties that include diagnosing the urolithiasis; sending the patient to the urologist as soon as possible in order to have immediate and specific treatment administered;

following up the patients and offering them support for further treatment procedures like extracorporeal shock wave lithotripsy (ESWL), ureteroscopy, JJ reinsertion, conservative treatment; and following up on the compliance of patients regarding dietary regime, and identifying recurrences knowing that these can be frequently asymptomatic.

Pregnancy represents a particular situation, as these women cannot be investigated or treated by means of radiology. Any pregnant woman with signs of urological disease must be urgently sent to a urologist, while we feel that pregnant women with a history of lithiasis should have at least a urological consultation during pregnancy. In our study, 8 pregnant women had a lithiasic history, with only 3 of them requiring endourological procedures after delivery. Urolithiasis is one of the main non-obstetrical causes of hospital admission in cases of pregnant women.[15] Identifying pregnant women with lithiasis is important not only from a urological point of view, but also given the fact that it is frequently associated with preeclampsia, hypertension and diabetes, thus necessitating caesarean delivery.[16] Despite the fact that lithiasis has an increasing frequency among the population, it remains constant among pregnant women.[17] From the same point of view, urinary infection in pregnant women should be identified and treated even if they are asymptomatic. In every case, a pregnant woman should have a urine culture in the first three months.[18] Because of urine features in case of pregnancy, the renal drainage must be strictly followed up, as they represent a high risk of calcification, even requiring additional procedures, reinsertions and more costs.[19] Generally speaking, pregnant women do not tolerate the stents very well, as they represent a source of infection; indeed, the biofilm does not let the antibiotics penetrate. In case of changing the stent or nephrostomy, these germs can reach circulation.[11]

Conclusion

In order to avoid complications and increase the risk of urosepsis, a patient-general practitioner-specialist collaboration is vital. The absence of fever or chills does not mean that there is a harmless infection which can be treated in ambulatory, and with no need for further investigation. The empirical use of antibiotics in cases of the above-mentioned pathology led to a delay in proper management, thus making hospitalisation longer and increasing the costs significantly. The patient profile which was most in need of increased funding was as follows: female patient aged over 57 years, with renal insufficiency, leukocytosis, neoplasic aetiology of the hydronephrosis, delayed drainage, and a long hospitalisation.

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