

**UNIVERSITY OF MEDICINE AND PHARMACY
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**PhD THESIS
ABSTRACT**

***FEATURES OF URINARY TRACT
INFECTIONS AT NEONATES, INFANTS AND
TODDLERS***

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KEY WORDS: *urinary tract infection, predisposing factors, decisive features, morphological abnormalities*

INTRODUCTION

Urinary tract infections are inflammatory diseases of infectious etiology of urinary tract infection and / or renal interstitice. At newborn, infant and toddler up to 3 years, urinary tract infections are a major health problem, due to high incidence, sometimes unpredictable clinical course, the risk of possible complications, relapse and significant impact on renal function. All these occur due to a nonspecific symptomatology and to an evolution under the guise of some comorbidities. At early ages, mostly, the first urinary infection remains undiagnosed, the pain being put under another diagnosis.

The diagnostic and therapeutic approach of a urinary tract infection requires its recognition as a cause of disease, the promptitude and the accuracy of the diagnosis as well as the early institution of the treatment (Tullus, 2012). For the disease diagnosis as well as for the application of an early therapeutic plan, it is necessary a high index of suspicion, especially at newborns and infants. The late recognition of the condition and the complexity of the issues it raises from therapeutic point of view favour the installation and the progressive development of serious injuries, sometimes irreversible, in the renal parenchyma.

Given the fact that the symptoms and signs of urinary tract infection are not specific, but differ according to age, aetiology and the location of the infection, ***the aim of our study*** was to find the essential criteria to guide to early diagnosis of urinary tract infection at newborn, infant and toddler. In this respect, we proposed the achievement of several ***objectives***, including the study of risk factors, the analysis of how it begins and of the correlation between the urinary tract infection and the dominant symptom, the fever, the related pathology study, the join of morphological abnormalities, the study of the recurrence and the appreciation of clinical and laboratory changes to argument and sustain the urinary tract infection diagnosis.

The practical importance of the research has emerged as a result of the need to early detect a urinary tract infection, given the high morbidity, the etiologic

diversity and the possibility of chronic development, of relapse, increase the risk of permanent sequels, by affecting a growing organ – the kidney.

Among the **aspects with original character**, the correlation of the urinary tract infection with several parameters (demographic, etiologic, clinical and functional) allowed to be established the extent to which their knowledge is useful for rapid diagnosis of the disease which, by the different response of the body to microbial aggression and the multiple incriminated predisposing factors, it manifests symptomatically or asymptotically, located in the lower, upper ways or in the whole urinary tract and may have a unique acute evolution, recurrent, persistent or chronic.

By the complexity of the issues highlighted, with therapeutic and prognostic implications, the results of our study are useful for the practicing physician and indicate the need for establishing some clear criteria of diagnosis and a closer monitoring of the patients with urinary tract infection.

The thesis has 166 pages, 77 tables, 45 figures and 144 references. It is classically structured, into two parts: a first part, **“The stage of knowledge”**, consisting of three chapters, containing the data from the literature from the field and the second part **“Personal contribution”**, made of four chapters, in which the results of personal research are represented.

The partial results of the study conducted during the four years have been presented at scientific meetings and events in the researched field and disseminated by the publication of three articles in relevant journals, indexed in international databases.

For the support offered in making this thesis, I want to thank the staff of the Pediatric Clinic of the Municipal Hospital, Craiova Philanthropy”, which allowed my clinical and paraclinical study of the hospitalized patients.

For the guidance and suggestions I have received throughout the period of making the research, I thank and present my best regards to Mrs. Florica Popescu, doctor university professor, the scientific leader of this thesis.

PART I: THE STAGE OF KNOWLEDGE

CHAPTER 1. Urinary tract infection. General aspects

In this chapter we introduced synthetic data that contain the definition, the incidence and the classification of urinary tract infection, an inflammatory process of the urinary organs and / or of the renal interstitium, with a rising incidence at infants and toddlers.

The term that certifies the infection by pyuria reveals the presence of a high number of polynuclear neutrophils in the urine, an expression of a process of defense against the infection, and the bacteriuria defines the presence of over 100,000 (10⁵) viable bacteria / ml of urine, which indicates the infection (significant bacteriuria). Both pyuria and bacteriuria are, however, value of symptom (Frederick et al., 2008).

CHAPTER 2. Pathogenic and physiopathological aspects

The chapter exposes modern concepts regarding the factors involved in the urinary tract infection (determinants, predisposing, of protection), the routes of infection of the urinary tract, the defence mechanisms, the bacterial colonization and the bacterial adhesion.

The urinary infection does not occur necessarily once with the massive bacterial colonization of the urinary tract. The ability of bacteria to adhere or not to the urinary tract is one of the most important factors in the initiation of the urinary tract infection (Chang et al., 2006). The interpretation of the risk factors should take into account both the characteristics of the pathogen agent and the host area with which it comes into contact, therefore its susceptibility (Chon et al., 2001).

CHAPTER 3. Clinical and laboratory features

The possibilities that the urinary tract infection is being clinically known are varied and often subtle. The clinical picture of the urinary tract infection at newborn, infant and toddler can take one of the following clinical forms: acute, recurrent, chronic - symptomatic or asymptomatic.

The recurrent urinary tract infections or the reinfections are usually the privilege of small ages, mostly associated with malformative uropathies. Sometimes, however, they are not associated with malformative uropathies, taking the name of idiopathic recurrent urinary tract infections, commonly at girls (Dacher et al., 2004 Halek et al., 2010).

PART II. PERSONAL CONTRIBUTIONS

AIM OF THE STUDY. SET OBJECTIVES

The purpose of the study, **motivated** by the practical need to deepen the knowledge of etiologic, clinical, biological and imagistic order of the urinary tract infection, is to achieve the analysis of the utility of some criteria to guide more easily towards the diagnosis of urinary tract infection at newborn, infant and toddler, 0-3 years, in order to be treated appropriately, scientifically and early, to stop the progressive development of the disease to complications.

The main **specific objectives** of the study include: the identification of the predisposing risk factors (prenatal, postnatal), of the determinant factors and their correlation with several parameters (genre, age, area of origin); the assessment of the relationship between the prematurity and the urinary tract infection; the analysis of the onset way and the correlation between the urinary tract infection and the dominant symptom, the fever; the knowledge of the conditions associated to the urinary tract infection; the establishment of the relation between the location of the urinary tract infection and the inflammatory syndrome; the evaluation of the morphological recurrences and the abnormalities; the assessment of the present clinical and laboratory changes.

THE STUDY GROUP. PROCEDURE

We performed **a retrospective study** on a sample of **495** patients diagnosed with urinary tract infection, selected from **a total of 12,551** patients hospitalized with general pathology, for a period of **five years** (2008-2012).

For the diagnosis of urinary tract infection, we took into consideration and used the clinical criterion as well as the laboratory criterion (the exam Urinalysis, bacteriuria and positive urine culture).

The positive urine culture was the decisive argument of the diagnosis when the quantitative presence of the germs was greater than 10^5 colonies / ml.

In our study there were not included the children whose urine culture was negative and showed no elements of pathological significance.

RESULTS

In a first part of the results, we presented *the study of the risk factors according to gender, age group and area of origin at patients with urinary tract infection* and we analyzed then *the relationship of this infection with prematurity. The prenatal factors* have been identified in a number of **84 patients** with urinary tract infection (Table 1).

<i>Prenatal factors</i>	<i>Number of female patients</i>	<i>%</i>	<i>Number of male patients</i>	<i>%</i>
Eclamtics	13	5.18	16	6.56
Imminent abortion	3	1.20	8	3.28
Prolonged pregnancy	6	2.39	9	3.69
Smoking	2	0.80	4	1.64
Alcohol	1	0.40	2	0.82
Contraindicated drugs	2	0.80	3	1.23
Spasmohilia at mother	3	1.20	1	0.41
Diabetes at mother	3	1.20	0	0.00
Bacteriuria at mother	3	1.20	5	2.05

Table 1. The distribution of patients according to the presence of risk prenatal factors and genre

The distribution of the studied cases according to the age and genre group, in the presence of predisposing prenatal factors, was also shown.

The presence of **postnatal factors** did I found at a number of **411** patients.

The prematurity, the prolonged jaundice, the artificial feeding and the urinary infection at mother are the situations with high favorable potential of urinary tract infection in the postnatal period. We noted that the postnatal risk factors have a share of 83.04% compared to the prenatal ones, which have a share of only 16.96%.

From the study group it was identified a group of **32 patients prematurely born** that had an atypical onset of the urinary tract infection, dominated by one or two symptoms, by a syndrome or by the clinical picture of the associated disease (Table 2).

Number of prematurely born patients	The onset of the urinary tract infection at prematures									
	Febrile seizures		Dyspeptic syndrome		Prolonged jaundice		Lethargy		Clinical picture of the associated disorders	
	Number of patients	%	Number of patients	%	Number of patients	%	Number of patients	%	Number of patients	%
32	7	22	14	43	4	12	3	9	4	12

Table 2. The onset way of urinary tract infection at prematures

The determinant agent of the urinary tract infection at the 32 preterm was dominated by *E. coli* (55%), *Proteus* (11.5%), *Klebsiella* (10.5%) and *Pseudomonas* (6%).

The analysis of the determinant factors discerned, by our study, only for the infection with *Escherichia coli*, a **difference** between the distribution on **ages of the two genres**, the result of the **Chi square test was 0.008**, as over **50% of male patients were aged between 1 month and 1 year**.

Throughout **the analysis of clinical parameters**, according to age, the symptomatology took a nonspecific aspect and was dominated either by an infectious syndrome, or by one of the digestive, nervous, or urinary or respiratory (Figure 1).

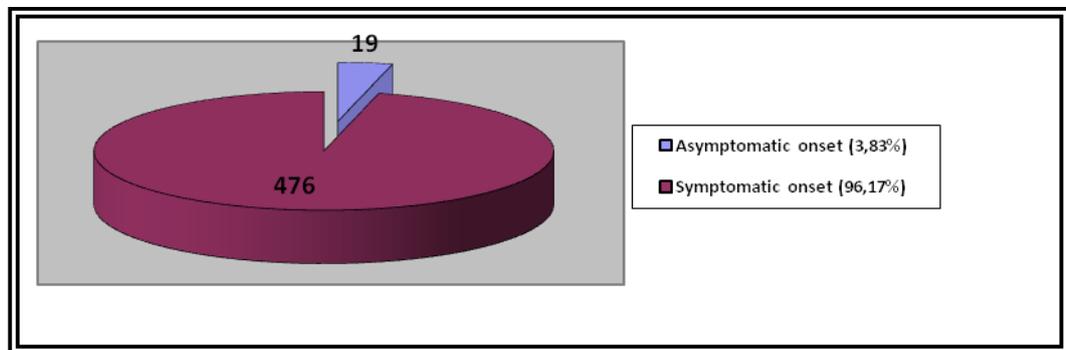


Figure 1. Distribution of patients according to onset

Besides the type of the symptomatic or asymptomatic onset, another important aspect of our study was **the assessment of the time from the onset of the disease to the hospitalization** in the clinic. We identified **significant differences related to the time from onset to hospitalization, according to the age group of the subjects**. Chi square test returned a smaller results than the level of 0.05, i.e. **$p = 0.005427$** , thus making objective the observation that, **once with growing older, the duration from onset to hospitalization increases**.

It is also noted that most cases were hospitalized within 24 hours or up to maximum 1-2 days. **There are highly significant differences related to the presence of fever depending on the age of the subjects, thing highlighted by the result of the Chi square test, $p = 0.000675 < 0.001$** . We found that over **80% of those aged less than one month had fever, moderate or high, while in other age groups, the percentage was 43%, 35%, respectively 31%**.

The urinary tract infection, as shown in our study, ***is also associated with other pathology***, which is the main reason for hospitalization (Figure 2).

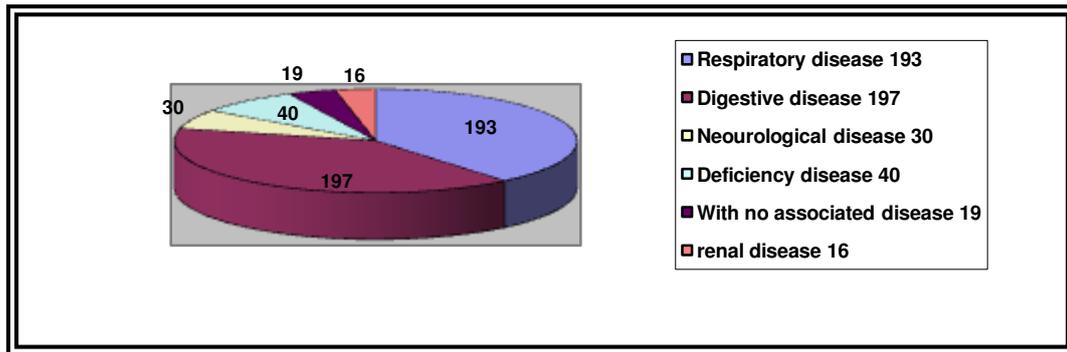


Figure 2. The distribution of patients according to the presence of associated diseases

The localization of the urinary tract infection based on clinical data analysis correlated with the inflammatory syndrome, revealed that 82 patients, respectively 16.50% were diagnosed with high urinary tract infection, while low urinary tract infection was recorded at 413 patients.

The results of the study points out that ***there are significant differences in the distribution according to age group of the subjects and the localization of urinary tract infection, high or low, because of the result of Chi-square test was $p = 0.0014$.***

The main element of the inflammatory syndrome was the C-reactive protein. The technical difficulties have allowed the tracking of the C-reactive protein, quantitatively, only 24 cases, while at the other 58 cases it was recorded only its positivity. All cases were associated with an inflammatory anemia too.

The presence of ***the inflammatory syndrome*** (ESR > 10 mm / h), the leukocytosis, and the C-reactive protein are highly correlated with high urinary infection.

The association of the morphological abnormalities with urinary tract infection identified 13 patients with renal-urinary malformations at which the urine culture showed the Proteus bacillus being the most frequent, in 38.46% of cases, followed by Klebsiella 23.07% and E. coli 30.76%. Other bacteria had a percentage of 7.69%.

The study of the recurrence of the urinary tract infection during the five year study showed the persistence and the reinfection of the urinary tract more frequently after the age of one, aspect shown in Table 3.

Age group	Total number of patients with urinary tract	Persistence Relapse				Reinfection			
		Number of male patients	Number of female patients	Total number	%	Number of male patients	Number of female patients	Total no.	%
1 month-1 year	222	2	1	3	1,35	3	4	7	3,15
1-2 years	158	4	2	6	3,79	4	2	6	3,97
1-3 years	98	3	2	5	5,10	2	2	4	4,08

Table 3. The distribution of patients according to the type of recurrence, age group and genre

To argument and sustain the diagnosis of urinary tract infection, I considered the clinical and laboratory data, resulted from our study, focusing on those suggestive and representative, represented in Table 9. To outline the diagnosis, I considered also the clinical picture of the disease the child was hospitalized, aspect illustrated by the table 10, which, also, accumulates the total of all four age groups.

Symptoms and clinical signs	Number of cases	%
Temperature > 38,50 C	413	83,4%
Temperature < 38,50 C	82	16,6%
The stationing of growth rate	272	55
Digestive disorders	359	72,5
Prolonged jaundice	11	2,2
Neurological signs	336	67,8
Malaise	364	73,5
Bed smelling urine		
Agitation at urination	273	55,1
	119	24

Table 4. Symptoms and present clinical signs

Disease	Number of patients	%
Respiratory	193	38,9
Digestive	197	39,7
Neurological	30	6
Deficiency	40	8
Reno-urinary	16	3,23

Table 5. The affection at hospitalization

In the second stage of establishing the diagnosis of urinary tract infection there were analyzed the urine and urine culture.

I have not found a significant difference between boys and girls regarding positive or negative urine culture, the Chi square test result being $p = 0.736$. **There are, however, highly significant differences in the urine culture according to the age group ($p = 1.44 \times 10^{-6} < 0.001$), being noticed the increase of the percentage of negative urine cultures once with growing age of the subject.**

DISCUSSIONS

Our study, of retrospective type, was conducted on a sample of 495 patients diagnosed with urinary tract infection, aged 0 to 3 years, selected from the 12 551 patients with various diseases, specific to pediatric pathology, hospitalized at the Pediatric Clinic Section of the Municipal Hospital "Philanthropy" Craiova, in the period 2008 - 2012. Reported to general pathology, the incidence of urinary tract infection was 495 (3.94%) cases, a percentage consistent with the literature data (Smith, 2007) which give close values.

The study group included 244 male patients and 251 female patients, analyzed in different subgroups according to the age group: newborn (0-1 month), infant (1 month-1 year) and toddler (1 - 2 years and 2-3 years).

In the group I did not identify significant differences in the distribution of patients according to genre and year of hospitalization, the Chi square test result being $p = 0.348 > 0.05$. **There are, however, differences in the distribution by genre and age ($Chi\ square = 0.016\ p < 0.05$).** Male patients represent a larger percentage of cases aged between one month and one year.

Depending on **the year of hospitalization**, for the cases included in the study group there was recorded **a highly significant difference** (Chi square test result $p = 0.000559 < 0.001$) **between the distribution by area of origin, rural and urban.** Generally, **over 60% of the subjects were from urban areas**, with the exception of the years 2009 (85% in urban areas) and 2010 (only 58% in urban areas).

The study of risk factors at patients with urinary tract infection is based on the data from the literature (Chon et al. 2001) which highlight that the

susceptibility of the urinary tract to develop infections with pathogen germs is enhanced by some **predisposing factors**, which are found in the both **prenatal and postnatal** period. Regarding the prenatal period, from our study it is noted that the most likely to have urinary tract infections are the children whose mothers had eclamtics, imminence of abortion (risk pregnancies), prolonged pregnancy or a pathological load (diabetes, bacteriuria).

In the study group, out of the 84 patients with urinary tract infection at which I identified the presence of prenatal factors, a number of 36 (14.34%) were female and 48 (19.67%) were males.

I detected **a significant relationship between prenatal risk and the age of the subjects (p Chi-square = 0.00456)**. It is noted **the much higher percentage of the subjects under a month** that had such risk factors present, **41.18%**, much different from other **age** groups.

Postnatal risk factors were identified at 411 patients from the study group. Our study demonstrated that postnatal risk factors have a percentage of 83.04% compared to the prenatal ones which had a percentage of 16.96%.

There are also highlighted several issues: prematurely born children, fetuses with low birth weight, prolonged neonatal jaundice, early artificial nutrition, children born from twin pregnancies, demonstrate the fragility of the field which facilitates the graft of the infection of the urinary tract.

In relation to the age of patients, we found significant differences (p Chi square = 0.004 <0.05) in the distribution of the total number of identified risk factors: 77.93% of cases aged between **one month and one year** had a single risk factor, **10.81%** had two factors, while in the other **age groups**, a higher percentage between **59.49% and 63.27%** of **patients had a single factor** and at a lower percentage **between 15.19% and 18.37%**, there were recorded **two factors**.

Regarding **the relationship between prematurity and urinary tract infection**, from the study group there was identified a group of 32 patients born prematurely at which it was noted that the **onset of infection** was atypical, dominated by one or two symptoms, by a syndrome or by the clinical picture of the associated disease.

The determinant factor of the urinary tract infection at the 32 prematures was dominated by *E. coli* (55%), *Proteus* (11.5%), *Klebsiella* (10.5%) and *Pseudomonas* (6%).

The determinant factors of the urinary tract infection, represented by bacteria, were analyzed according to the type and number of germs involved, for each year of study, on age groups and gender.

Through our study, we found only for the infection with *Escherichia coli* **difference** between the distribution on **ages of the two genres**, the Chi square test result **being 0.008**, because over **50% of infected boys were aged between 1 month and 1 year**.

In the conditions of the study, the etiologic spectrum of urinary tract infections in children 0-3 years was dominated by *Escherichia coli* (45.86%) followed by *Klebsiella* (31.51%) and, with lower frequency, by *Proteus* (17.78%). Our observations are, thus, consistent with the data provided by other studies (Williams et al., 2008, Rai et al., 2008).

At a total of 20 patients, from the drawn data, we noted the involvement in the urinary tract infection of two germs. These cases appeared with two or three hospitalizations, they represent a rate of 4.04% and are explained by the coexistence of an infectious disease, respiratory, digestive or urinary malformative.

The second aspect of the study concerns the analysis of the clinical parameters from the urinary tract infection.

We identified the main **types of onset of the urinary tract infection and the time from onset to hospitalization** after which we **determined the existing correlation with the dominant symptom, the fever.**

At none of the children included in the study, **the type of onset** was not typical. Depending on age, the symptomatology had a nonspecific aspect and was dominated either by an infectious syndrome or by one of the digestive, neurological, respiratory or urinary syndromes.

Regardless of the age category and the dominant syndrome, the clinical manifestations are slightly different at newborn and infant, but the alteration of the general condition and the fever are found in a percentage above 90% at first age groups.

At children 0-1 month, fever, digestive disorders, the stopping of growth rate and the malaise were dominant manifestations.

At the age 1 month - 1 year too, the same manifestations dominated the clinical picture, but there have been cases also in which the onset was dominated either by nervous manifestations, at a percentage of 92.24%, or urinary, 66.66%, or respiratory, in a percentage of 43.24%.

At children from 1-2 years group, the onset was quasi similar, but there was added a micturition discomfort (agitation) and abdominal sensitivity.

At patients older than 2 years, the onset of the urinary tract infection was characterized by symptomatological associations.

Regarding ***the clinical manifestations at onset***, we objectified the existence of ***highly significant differences between the four age groups, the Chi square test result being $p = 2.71 \times 10^{-14}$, thus a lot below 0,001.***

Besides the symptomatic onset, the urinary infection was installed and also asymptotically, in a percentage of 3.83%, the diagnosis being established from the urine exam, which is part of mandatory screening.

Making ***an assessment of the time from the onset of the urinary tract infection to hospitalization***, we noticed that it is variable and is recorded from 24 hours to 7 days.

We identified ***significant differences related to time from onset to hospitalization, according to the age group of the subjects.*** The Chi square test returned a smaller result than the level of 0.05, i.e. ***$p = 0.005427$, thus objectifying the observation that, once with the growing age, the time from onset to hospitalization increases.*** It is noted that most cases were hospitalized within 24 hours or up to maximum 1-2 days.

Regarding the relationship with the dominant symptom, the fever, I made judgments based on age and genre.

We found highly significant differences related to the presence of fever, depending on the age of the subjects, as highlighted by the Chi square test result, $p = 0.000675 < 0.001$.

By our study, we found that over 80% of those aged less than one month had fever, moderate or high, while, at other age groups, the percentage was 43%, 35%, respectively 31%.

The study of the pathology associated with the urinary tract infection emphasizes that the digestive, neurological and deficiency respiratory diseases

aggravated the diagnosis, as well as the therapeutic conduct. Only in 19 of these cases, the urinary tract infection has not been associated with other diseases.

The analysis of the relationship between the type of the associated diseases and the age group indicates that there are no major differences in terms of pathology detected at different ages, the Chi square test returning $p = 0.113$, thus over the maximum admitted limit, 0.05. ***Neither on gender did we note significant differences related to the general type of the comorbidities***, the Chi square test being a lot over the admitted limit ($p = 0.724$).

The localization of the urinary tract infection and the relationship with the inflammatory syndrome has a special value, because of the local and remote injuries, by the consequences both on a segment of the tract, and the general condition, respectively on the whole body (Smith, 2001).

The analysis of the clinical data, linked with the inflammatory syndrome revealed that 82 patients, respectively 16,50%, had been diagnosed with high urinary tract infection, while the lower urinary tract infection was recorded at 413 patients.

By our study it was noted that there are ***significant differences in the distribution according to the age group of the subjects and the localization of the urinary tract infection, high or low. The result of Chi-square test was $p = 0.0014$, thus a lot smaller than the limit of 0.05.***

Although, at any of the age groups, the lower urinary tract infections predominates, it is noted ***an increase of the high urinary tract infections once with the growing age of the subjects in the study.***

The presence of the ***inflammatory syndrome***, $ESR > 10$ mm / h, leukocytosis and C-reactive protein ***correlates with the high urinary infection.***

Regarding the association of the morphological abnormalities with the urinary tract infection, considered a true risk factor, we noted, from the studied cases, a rate of 2.63% of morphological changes, detected using ultrasound. Most cases were detected at 1-2 years and 2-3 years age groups, more common at male patients.

The analysis of the urine samples from the patients with renal-urinary malformations highlighted most frequently the Proteus bacillus, in 38.46% of cases, followed by Klebsiella, 23.07%, and E. coli 30.76%. Other bacteria had a percentage of 7.69%.

As a special feature, we considered the identification moment, because only 4 cases with urinary tract infection were detected at the first episode, the remaining 9 cases being detected with the relapses. This observation strengthens the assumption that the morphological abnormalities remain a clear risk factor, especially for relapses (Roussey-Kesler et al., 2008).

The observations drawn from our study are consistent with the literature data, that appreciates that the early identification of the reno-urinary abnormalities is important, because, if not corrected, may constitute a reservoir for bacterial persistence and the determination of the recurrent urinary tract infections (Koyle et al. , 2007).

The study of the recurrent urinary tract infection reveals that, during the five years of study, the persistence and the reinfection of the urinary tract were diagnosed more frequently after the age of one year, overall, in a percentage of 6.26% of all 0 - 3 years patients included in the study.

The pathogen germ involved in the persistence and the relapse of the urinary tract infection at the cases selected by us was 51.6% E. coli, followed by Klebsiella, Proteus and Enterobacter. In 2.8% of cases with recurrence of the urinary tract infection, we did not found the aetiology.

From the evolution of the urinary tract infection, caused by germs persistence, it was highlighted that the onset of the new spurt presented a heterogeneous nonspecific, symptomatology, followed by the gradual installation of a dominant syndrome, poisoning, with the alteration of the general condition, adinamie, torpedoes, irregular fever or low grade fever, weight loss, digestive phenomena, retardation in growth and development. The recurrence of the urinary tract infection was more common at male patients, and related to the age, at children between 1 and 2 years, consistent data and with the literature reports.

Going through the achieved results, ***the diagnosis of urinary tract infection*** cannot detach from the symptoms and the clinical signs, where fever, decrease of the growth rate, the malaise, the digestive and neurological manifestations have weight.

The number of cases with positive urine culture was 444 (89.69%). At cases with the number of germs less than 100,000 colonies / ml urine, the urine cultures were tagged as negative. Their number was 51 (10.30%).

At negative urine cultures, our results allowed framing of 22 cases in the group of those with the urinary tract infection because of the association with clinical and laboratory features that had pathological significance. And this *observation overlaps those from the domain literature.*

There are highly significant differences related to the urine culture according to the age group ($p = 1.44 \times 10^{-6} < 0.001$), being noted that the increase in the percentage of negative urine cultures once with the growing age of the subjects.

As imagistic exploration, ultrasound was performed only at 26 patients, for the situations with prolonged evolution and recurrences.

CONCLUSIONS

Following the study conducted on a group of 495 patients with urinary tract infection, of both sexes, aged 0-3 years, from both rural areas and urban area, the following conclusions were drawn:

1. The patients with urinary tract infection have the susceptibility of contracting infections with pathogen germs, enhanced by ***predisposing factors***, which are found both in the ***prenatal*** and ***postnatal*** period.

2. The assessment ***of the relationship between the prenatal risk and the age of the subjects*** shows that ***there is a significant relationship*** between these two variables (***Chi-square $p = 0.00456$***). It is to be noted the much higher percentage of the subjects aged ***less than one month***, which had such risk factors present (***41.18%***), much different from the other age groups.

3. Our study on ***postnatal risk factors*** identified a percentage of ***83.04%*** compared to the prenatal ones who had a representation of only 16.96%. It is also highlighted the existent relationship between prematurity, low birth weight, prolonged neonatal jaundice, early artificial nutrition, twin pregnancies and the graft of the infection at the level of the urinary tract.

4. The study of ***the total number of the risk factors present at each patient*** highlighted that ***there are differences in the distribution of the total number of risk factors identified according to the age of the subjects (Chi square $p = 0.004 < 0.05$): 77.93 % of the patients aged between one month and one year had one risk factor***, and only ***10.81% had two factors***. At the other

categories, a higher percentage, **between 59.49% and 63.27%** of patients **had a single factor**, and at a smaller percentage, **between 15.19% and 18.37%**, **two factors** were recorded.

5. **The analysis of the determinant factors** shows that the germs mostly involved in the urinary tract infection at 0-3 years children were: 45.86% *Escherichia coli*, *Klebsiella*, 31.51% and *Proteus* 17.78%.

Our study detected only for the infection with *Escherichia coli* a **difference** between the **age distribution of the two genres, the Chi square test result being 0.008**, because **over 50% of the infected boys were aged between 1 month and 1 year**.

6. **The analysis of the clinical parameters of the urinary tract infection** allowed the identification of the main **types of onset of the urinary tract infection, of the time from onset to hospitalization** and **established the existent correlation with the dominant symptom, the fever**. Regarding the onset clinical manifestations, we objectified the existence of some **highly significant differences between the four age groups, the Chi square test result being $p = 2.71 \times 10^{-14}$, thus a lot below the 0,001 limit**.

We identified **significant differences related to time from onset to hospitalization**, according to **the age group of the subjects**. The Chi square test returned a result smaller than the 0.05 limit, i.e. **$p = 0.005427$, thus objectifying the observation that with growing age, the duration from onset to hospitalization increases**.

We found highly significant differences related to the presence of fever, depending on the age of the subjects, as highlighted by the Chi square test result, **$p = 0.000675 < 0.001$** .

By our study we found that over 80% of those aged less than one month had fever, moderate or high, while in other age groups, the percentage was 43%, 35% and 31%.

7. Considering **the association of the urinary tract infection with other diseases**, we noted that respiratory, digestive, neurological and deficiency hampered the diagnosis and the therapeutic conduct.

8. Our study **on the location of the urinary tract infection highlighted significant differences in the distribution according to the age group of the patients and the location of the urinary tract infection, high or low. The Chi-**

square test result was $p = 0.0014$, thus a lot smaller than the 0.05 limit. It is to be noted ***an increase of the high urinary tract infections once with growing age of the patients from the study. We have not identified significant differences between the cases with low urinary tract infection and high infection related to the values recorded for the biological parameters correlated with the inflammatory syndrome: ESR, number of leukocytes, number of erythrocytes, haemoglobin.*** For all the four comparisons, the **Student's t test results were greater than 0.05**, the maximum value that indicates a significant difference from statistically point of view. The presence of ***the inflammatory syndrome, ESR > 10 mm / h, leukocytosis and C-reactive protein correlates with high urinary infection.***

9. The ***study of the morphological abnormalities association with the urinary tract infection identified*** the presence of the most cases at the 1-3 years age group, more frequently at male patients, and etiologically speaking, the most often involved was the bacillus proteus. The morphological abnormalities remain an obvious risk factor, especially for recurrences, which favour the urinary tract infection and worsen its evolution.

10. **The study of the urinary tract infection recurrence** reveals that during the five years of study, the persistence and the reinfection of the urinary tract were diagnosed more frequently after the age of one year and may be an indicator of the association with other disorders.

11. **The diagnosis of urinary tract infection** is difficult to establish, given the many favouring factors, the atypical onset, the nonspecific symptomatology and the association with other disorders. In the diagnosis of urinary tract infection, it was noted the correlation of the bacteriuria with leucocyturia. The interpretation of this correlation in a suggestive clinic-biological context increases the chance of a correct diagnosis.

12. The urine culture is the decisive element of diagnosis. By our study we did not find a significant difference between boys and girls in the positive or negative urine culture, the Chi-square test result being $p = 0.736$, but there are ***highly significant differences in the urine culture according to the age group ($p = 1.44 \times 10^{-6} < 0.001$), pointing out the increasing of the percentage of negative urine cultures with growing age of the subjects.***

13. The diagnosis of urinary tract infection, the systematization of the clinical, biological and imagistic elements outlined the two major stages, clinical and laboratory. The biological constants have completed the diagnosis and offered the possibility of assessment of the stage of the urinary tract infection.

14. Our study is **original**, being ***a contribution to the complex approach of the patients with urinary tract infection, based on the knowledge of the involved risk factors, on clear diagnostic criteria and easily accessible to the medical practitioner. The fast establishment of the diagnosis and the application of a prompt treatment have a great importance in reducing the morbidity and the improving the prognosis of this disease.***

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