

# Biochemical Markers of Hydronephrosis During Pregnancy

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*Ureterohydronephrosis is a urological disease that can affect pregnant women in any trimester, but it also occur physiologically in the second trimester. The study included a group of 119 pregnant women diagnosed with ureterohydronephrosis. The diagnostic difficulties of the urological pathology in pregnancy are outweighed by the contribution of the biochemical assessment of patients, correlated with non-invasive imaging investigations. The results of the study highlight the peculiarities of these investigations in this group of patients and the possibilities of differential diagnosis.*

**Keywords:** ureterohydronephrosis, pregnancy, biochemical markers

Physiological hydronephrosis may occur at the end of the first trimester and increase in severity as the gestation age increases [1, 2]. This physiological dilatation is caused by a combination of hormonal and mechanical effects. High levels of progesterone and gonadotropin are responsible for smooth muscle relaxation and can produce a hypotonia of the renal pelvis and ureter. Mechanical compression of the ureter by the fetus is the main effect of physiological hydronephrosis. Dilation of the upper urinary tract during pregnancy is a phenomenon known and studied by the researchers [3].

It is widely accepted that when pains become difficult to control or are associated with fever it becomes necessary to make endoscopic maneuvers. Of these, the least aggressive solution is the insertion of the JJ probe under ultrasound control. Our study aims to evaluate as accurately as possible this therapeutic solution, especially since, in almost all cases, the probe was kept until the end of pregnancy [4-7]. The purpose of this study is to evaluate the diagnostic and therapeutic problems related to ureterohydronephrosis in pregnancy and to monitor the impact of the autostatic ureteral tube in the studied group.

## Experimental part

### Material and methods

We evaluated biochemical parameters in a group of 119 pregnant women diagnosed with hydronephrosis, out of a total of 165 women with urological pathology, in different pregnancy trimesters. We made statistical correlations of these data for differential diagnosis, especially with physiological hydronephrosis.

The diagnosis was based on clinical features, laboratory data and echography, 72.12% of cases with hydronephrosis without ultrasound lithiasis were present in the study group.

## Results and discussions

Acute hydronephrosis is a pathological consequence of a physiological condition. Partial or total obstruction of one or both ureters may or may not be accompanied by urinary infection and has been found to occur especially in primiparous women. Diagnosis is often difficult because it is very hard or even impossible to distinguish an intrinsic

obstacle (calculi) from extrinsic obstruction of the ureter by compression caused by the pregnant uterus, in the limitation of imaging investigations.

The division of the study group on gestational age was made in parallel with the exclusion of 46 patients presenting with other urological diseases. Thus, 29.09% of patients were in the first trimester of pregnancy, 37.58% in the second and 5.45% in the third trimester of pregnancy.

### Clinical manifestations

Renal colic is the most common form of acute hydronephrosis in pregnancy (62.31%) and occurs in most cases on the right side. In rare situations, when obstructions was bilateral, colic is accompanied by oliguria or even anuria.

### Imaging evaluation

Due to restrictions in the investigation of pregnancy, it arises problems in choosing the diagnostic method. The absence of a *gold standard* makes it impossible to determine the sensitivity and specificity of renal ultrasound, but which ultimately remains the method of choice for diagnosis because it is cheap, fast and without risk to both the mother and the fetus.

It has been noted that serum urate and serum creatinine levels can be increased in bilateral hydronephrosis and if clinical signs advocate for infection, it is advisable to perform the hemoleogram, VSH and C-reactive protein from 3 to 3 days until these symptoms disappear under proper treatment. The reference values are for urea 20-40 mg%, serum creatinine 0.6-1.3 mg% and VSH 2-4 (table 2 and fig.1).

### Laboratory diagnosis

The cytobacteriological examination and urine summary revealed that there are no changes in the absence of infection, supplemented with uroculture if they are pathological. Uroculture was negative in 66 (55.46%) of cases and positive in 53 (44.54%), the result of uroculture being shown in table 1.

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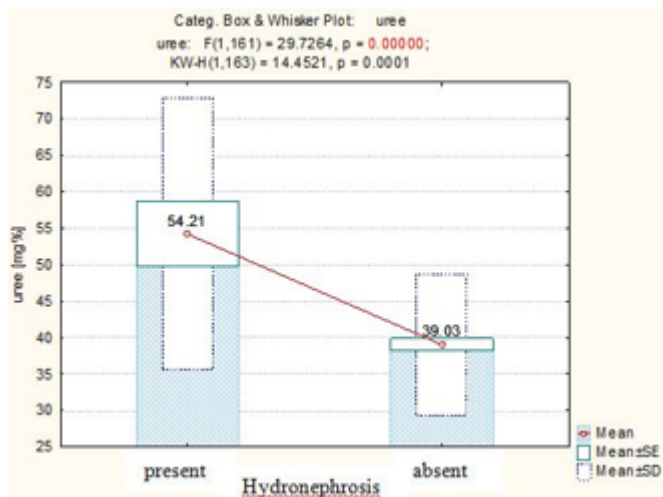


Fig.1 Average value, standard deviation and standard urea error

Table 1

URINE CULTURE IN THE HYDRONEPHROSIS OF THE STUDIED GROUP

| Urinalysis            | Nr. of cases | %      |
|-----------------------|--------------|--------|
| <b>Negative</b>       | 66           | 55.46% |
| <b>Pozitive</b>       | 53           | 44.54% |
| <i>E. coli</i>        | 48           | 40.34% |
| <i>Proteus</i>        | 1            | 0.84%  |
| <i>Enterococcus</i>   | 2            | 1.68%  |
| <i>Klebsiella</i>     | 1            | 0.84%  |
| Mixed Bacterial flora | 1            | 0.84%  |
| <b>Total</b>          | <b>119</b>   |        |

Table 2

STATISTICAL INDICATORS OF UREA VALUES IN THE STUDY GROUP

|             | Average | Average |       | Std. dev. | Std. err. | Min   | Max   | Q25   | Median | Q75   |
|-------------|---------|---------|-------|-----------|-----------|-------|-------|-------|--------|-------|
|             | urea    | -95%    | -95%  |           |           |       |       |       |        |       |
| With UHN    | 54.21   | 44.63   | 63.78 | 18.62     | 4.52      | 19.00 | 87.50 | 45.00 | 54.80  | 61.40 |
| Without UHN | 39.03   | 37.46   | 40.61 | 9.63      | 0.80      | 22.00 | 71.00 | 32.50 | 37.00  | 43.00 |
| Total       | 40.61   | 38.79   | 42.44 | 11.78     | 0.92      | 19.00 | 87.50 | 33.00 | 38.00  | 46.00 |

|           | Average | Average |       | Std. dev. | Std. err. | Min   | Max   | Q25   | Median | Q75   |
|-----------|---------|---------|-------|-----------|-----------|-------|-------|-------|--------|-------|
|           | Urea    | -95%    | -95%  |           |           |       |       |       |        |       |
| Right     | 36.45   | 35.14   | 37.77 | 6.55      | 0.66      | 22.00 | 52.00 | 32.00 | 36.00  | 40.00 |
| Bilateral | 55.66   | 51.28   | 60.03 | 9.35      | 2.09      | 29.00 | 71.00 | 51.80 | 56.00  | 60.85 |
| Left      | 36.18   | 33.58   | 38.78 | 6.71      | 1.27      | 26.00 | 52.00 | 32.00 | 36.50  | 39.00 |

Table 3  
STATISTICAL INDICATORS OF UREA VALUES IN THE STUDY GROUP

It has been noted that serum urate and serum creatinine levels can be increased in bilateral hydronephrosis and if clinical signs advocate for infection, it is advisable to perform the hemoleogram, VSH and C-reactive protein from 3 to 3 days until these symptoms disappear under proper treatment. The reference values are for urea 20-40 mg%, serum creatinine 0.6-1.3 mg% and VSH 2-4 (table 2 and fig.1).

Statistical indicators of the correlation between urea and hydronephrosis are shown in table 3.

Creatinine and VSH values were also analyzed in the same manner (table 4, fig.2, table 5, fig.3).

The leukogram showed significant changes in only 47 cases (28.49%). The importance of leukocytosis as a decision-making element in speeding up intervention is, according to our statistics, a question mark - postponing the establishment of drainage only because the leukogram

is within normal limits, endangering the favorable evolution of pregnancy (fig.4, tables 6, 7, fig.5). White blood cell counts did not change in hydronephrosis compared to those without hydronephrosis ( $F = 0.00001$ ,  $p = 0.997$ , 95% CI) ( $14.68 \pm 4.36DS$ ).

Although the statistical results of the study group revealed 47.9% of patients with fever and chills fever and chills, the ultrasound examination showed changes in only 27.7%. These data correspond to those in the literature [8]. This suggests that not all cases with infectious syndrome have specific echographic changes [9, 10].

The literature [11, 12] reveals that in blood it was noted that values of urea and serum creatinine may be increased in bilateral hydronephrosis, and if the clinical signs suggests an infection it can be indicated specific analyzes, such as blood count, VSH and a C-reactive protein. Similar results have been obtained in our study.

|             | Average    | Average |      | Std. dev. | Std. err. | Min  | Max  | Q25  | Median | Q75  |
|-------------|------------|---------|------|-----------|-----------|------|------|------|--------|------|
|             | creatinine | -95%    | -95% |           |           |      |      |      |        |      |
| with UHN    | 0.96       | 0.75    | 1.17 | 0.42      | 0.10      | 0.35 | 1.78 | 0.70 | 0.80   | 1.21 |
| without UHN | 1.36       | 1.27    | 1.45 | 0.55      | 0.05      | 0.68 | 3.40 | 0.90 | 1.30   | 1.65 |
| Total       | 1.32       | 1.23    | 1.40 | 0.55      | 0.04      | 0.35 | 3.40 | 0.90 | 1.27   | 1.65 |

**Table 4**  
STATISTICAL VALUES OF CREATININE VALUES IN THE STUDY GROUP

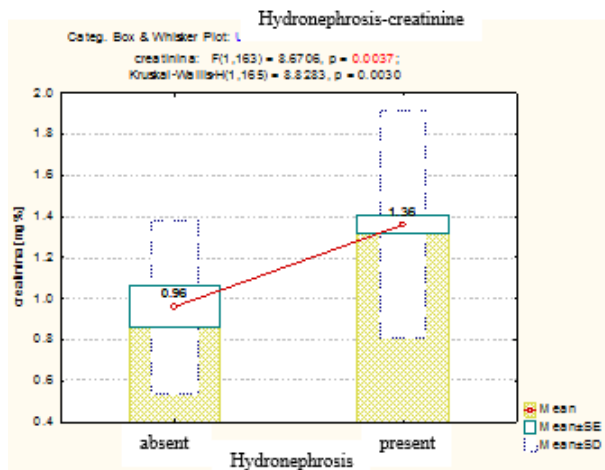


Fig.2 Average value, standard deviation, and standard creatinine error

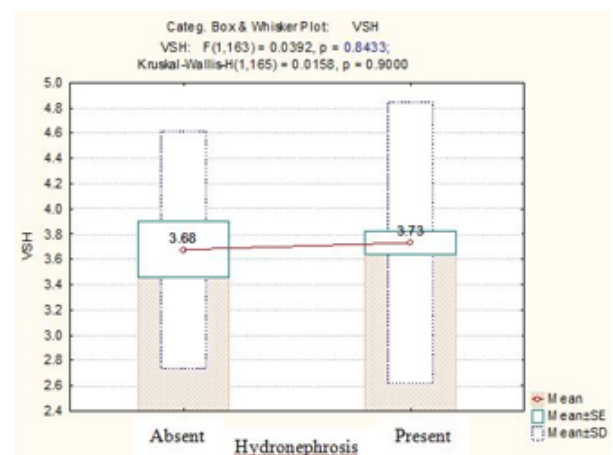


Fig.3 Average value, standard deviation, and standard error of VSH values

|             | Average | Average |      | Std. dev. | Std. err. | Min  | Max  | Q25  | Median | Q75  |
|-------------|---------|---------|------|-----------|-----------|------|------|------|--------|------|
|             | VSH     | -95%    | -95% |           |           |      |      |      |        |      |
| without UHN | 3.68    | 3.21    | 4.14 | 0.94      | 0.22      | 2.30 | 5.70 | 3.10 | 3.60   | 4.20 |
| with UHN    | 3.73    | 3.55    | 3.91 | 1.11      | 0.09      | 2.10 | 6.10 | 2.90 | 3.40   | 4.50 |
| Total       | 3.73    | 3.56    | 3.89 | 1.09      | 0.09      | 2.10 | 6.10 | 2.90 | 3.50   | 4.50 |

**Table 5**  
STATISTICAL INDICATORS OF VSH VALUES IN THE STUDY GROUP

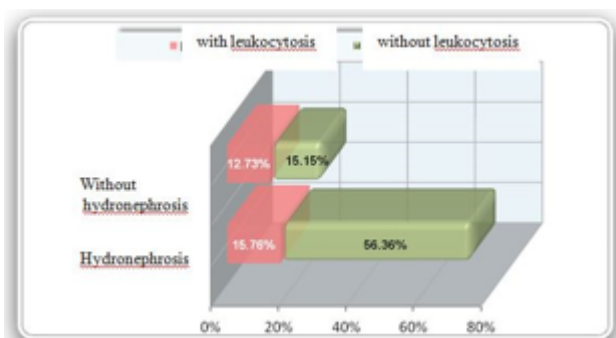


Fig.4 Leukocytosis vs. Hydronephrosis

In the presence of hydronephrosis, urea levels are significantly higher ( $F = 29.7, p < 0.05, 95\% \text{ CI}$ ) ( $54.2 \pm 18.6\text{DS}$ ), probably due to vomiting or insufficient water intake due to worsening of fluid ingestion, known in current urological medical practice [13, 14]. In the presence of bilateral hydronephrosis, creatinine levels are significantly higher ( $F = 8.67, p = 0.0037, 95\% \text{ CI}$ ) ( $1.36 \pm 0.55\text{DS}$ ). In the case of bilateral hydronephrosis urea values are

**Table 6**

ESTIMATED PARAMETERS IN LEUKOCYTOSIS VS. TRIMESTER OF PREGNANCY

|  | Chi-square $\chi^2$ | P                       |
|--|---------------------|-------------------------|
|  |                     | 95% confidence interval |
| Pearson Chi-square - $\chi^2$                | 1.073572            | 0.30014                 |
| M-L Chi-square                               | 1.018162            | 0.31296                 |
| Coefficient of correlation (Spearman Rank R) | 0.259882            | 0.30304                 |

significant ( $F = 65.08, p < 0.05, 95\% \text{ CI}$ ) higher ( $55.7 \pm 9.35\text{DS}$ ).

Of the 91 patients whose treatment consisted of the insertion of the JJ probe, 89 cases (97.8%) had a favorable

**Table 7**  
STATISTICAL  
INDICATORS OF WHITE  
BLOOD CELL COUNTS IN  
STUDY GROUP

|             | Average   | Average |       | Std. dev. | Std. err. | Min   | Max   | Q25   | Median | Q75   |
|-------------|-----------|---------|-------|-----------|-----------|-------|-------|-------|--------|-------|
|             | Glob.albe | -95%    | -95%  |           |           |       |       |       |        |       |
| without UHN | 14.69     | 13.27   | 16.11 | 2.85      | 0.67      | 10.50 | 20.20 | 13.10 | 14.20  | 16.20 |
| with UHN    | 14.69     | 13.96   | 15.43 | 4.51      | 0.37      | 6.10  | 29.90 | 12.00 | 13.60  | 15.40 |
| Total       | 14.69     | 14.02   | 15.36 | 4.36      | 0.34      | 6.10  | 29.90 | 12.00 | 13.60  | 15.40 |

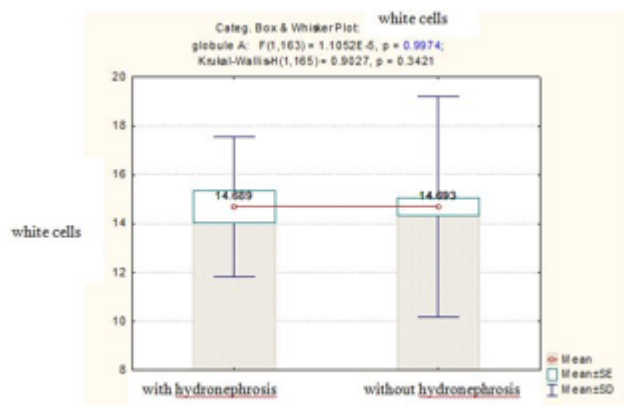


Fig.5 Average value, standard deviation and standard error of white blood cell counts

progression and in 2 cases (2.2%), the patients died in the context of severe sepsis, in despite ureteral drainage performed in emergency.

In the case of ureteral catheterization with JJ autostatic probe in some cases with favorable evolution (89 cases) it was necessary to change the probe so that the drainage was maintained and after giving birth, in the case of 27 pregnant (30.34%) after birth [15, 16]. Subsequent biochemical investigations revealed an idiopathic hypercalciuria that can explain, along with the well-tolerated urinary tract infection with *E. coli*, this incident.

### Conclusions

Differential diagnosis of hydronephrosis in pregnancy requires special professional experience of the treating physician. Clinical manifestations are common to the majority of urological diseases. Radiological investigation, dangerous for the fetus, especially during the first trimester of pregnancy, can be successfully replaced by echography. Correlation of imaging investigations with laboratory tests is imperative. In the diagnosis of certainty, the statistical indicators of the biochemical markers play a primordial

role because the drainage of the infected urine must be performed relatively quickly and the admitted antibiotic therapy during pregnancy should not be prolonged within 12 h when the clinical-biological evolution is not favorable.

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