

# The Role Of Cytological Examination Of Urine In The Diagnosis Of Urinary Tract Infections

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## Abstract

The cytological examination of (158) urine specimens was carried out in this study. It has been found that 105 (66.4%) samples gave positive results for urinary tract infection (U.T.I). Pus cells were found prevalent among other cell types (93.3%) of all positive UTI cases followed by epithelial cell (81.9%) and R. B. Cs (39%). Also it was found that pus cell casts were the dominant type, since it was present in (50.4%) of all positive UTI specimens, followed by hyaline casts (36.1%) granular casts (35.2%), epithelial cell casts (23.8%), RBC casts (19%), and other types (11.4%). The present study revealed that amorphous urate crystals had large percentage of crystal types (44.7%), other crystal types were present at various percentages: Calcium phosphate crystals (34.2%), Calcium oxalate crystals (35.2%), uric acid crystals (25.7%), sodium urate crystals (18.0%), Ammonium urate crystals (11.4%) and other (17.1%).

## INTRODUCTION

Urinary tract infection is an inflammatory response of the urothelium to bacterial invasion that is usually associated with bacteriuria and pyuria. Bacteriuria is the presence of bacteria in the urine, which is normally free of bacteria, and implies that these bacteria are from the urinary tract and are not contaminants from the skin, vagina, or prepuce. Pyuria is the presence of white blood cells in the urine and is generally indicative of an inflammatory response of the urothelium to bacterial invasion (Walsh, et al., 1998). Many studies show that the bacterial count must be approximately 30000/ml before bacteria can be found in the sediment (Stamm & Hooton, 1993 and Al-Saimary, 1998).

Urinalysis is one of the most important and useful urologic tests available, yet all too often the necessary details are neglected and significant information is overlooked or misinterpreted (Tanagho & McAninch, 1995). Since approximately 20% of patients who visit a primary physicians office have a urologic problem (Haber, 1988).

The examination of urine, or uroscopy is among the oldest practices in medicine, dating back to Babylonian physicians over 6000 years ago. (Schrier & Gottschalk, 1997). The complete examination of urine has by tradition been divided into macroscopic and microscopic evaluation. The macroscopic analysis of urine includes assessment of physical characteristics of urine (appearance, odor, specific

gravity) and chemical analysis. Microscopic analysis of the constituents of urine is performed on either an unspun specimen or, more usually, the sediment from centrifuged urine specimens (Bonnardeaux et al., 1994; and Mandal, 1988).

The urine sediment is examined microscopically for the presence of cells, casts, and crystals. Normal urine contains small numbers of these elements. An abnormal urine sediment contains either constituents of normal urine in abnormally high numbers, or constituents that are not usually present in normal urine in any number (Haber, 1988)

Some studies (Harding et al., 1991; Lohr et al., 1993 and Carroll et al., 1994) noticed that 70-90 percent of the patients with clinically evident urinary tract infection had positive cytology. Occasionally urinary cytologies are positive, although the initial diagnostic study fails to reveal urinary tract infection (Macfarlane et al., 1999; Wennerstrom, et al., 2000 and Theis et al., 2000).

The aim of this study is to determine the role and significance of cytological and/ or Microscopical examination of urine in diagnosis of urinary tract infections.

## MATERIALS & METHODS

A total of (82) midstream urine specimens were collected in sterilized tubes from male (45 cases) and female patients (37 cases) in age ranged between 20-30 years, with clinical

symptoms suggesting urinary tract infection. After centrifugation at 3000 rpm for 15 minutes, 0.1 ml from the sediment of each urine sample was spreaded on the following media: Nutrient agar, MacConkey agar and Blood agar (Difco). Samples were considered positive for urinary tract infection (U.T.I) when it yielded more than  $10^5$  bacterial cells/ ml of urine, while samples which yielded less than that were considered to be negative samples and were excluded from the stud, and the identification of bacterial uropathogens were carried out depend on routine laboratory techniques ( Finegold & Baron, 1986).

One drop from urine sediment of each sample was placed on a glass slide for cytological (microscopical) study, and examined by light microscope.

The examination methods and diagnostic feature for cytological investigation and culturing of urine were performed according to (Raphael, 1976; Schrier & Gottschalk, 1997 and Walsh et al., 1998).

**RESULTS**

The results showed that (105) samples (66.4%) from all urine specimens (158) gave positive results due to bacterial culturing for urinary tract infections, (70.5%. 61.6%) of these samples are positive for male and female patients respectively, table -1-.

**BACTERIAL UROPATHOGENS**

Table – 2 - showed the numbers and percentages of bacterial uropathogens isolated from male and female patients. It is obvious from the table that Pseudomonas aeruginosa was the predominant causative agent, since it was present in (83.8%) of all positive cases. Other bacterial uropathogens were present of various percentages as follows :

Escherichia coli (68.5), Staphylococci (46.6%), Klebsiella (32.3%), Proteus(25.7%) and Streptococci (14.2%).

**CYTOLOGICAL STUDY**

Pus cells were found prevalent among other cell types (93.3%) of all U.T.I cases, followed by epithelial cells (81.9%), and red blood cells (39%), details are shown in table –3 -.

Table -4- outlines the types of casts in male and female patients. It is obvious from the table that pus cell casts were the dominant type, since it was present in (50.4%) of all positive U.T.I cases, followed by hyaline casts (36.1%), and granular casts (35.2%) epithelial cell casts (23.8%), R.B.C

Casts (19%) and other types of casts (11.4%).

Types of crystals in urine specimens of U.T.I. patients are shown in table –5 -. There was a great percentage of amorphous urate (44.7%). Other crystal types were present at the following percentages; calcium phosphate (34.2%), calcium oxalate (35.2%), uric acid (25.7%), sodium urate (18.0%), ammonium urate (11.4%) and other types of crystal (17.1%).

**Figure 1**

Table 1: Numbers of positive specimens of urinary tract infections (depend on results of bacterial culture).

| Sex    | No. of specimen | *No. of positive bacterial culture | Percentage of +ve culture (%) |
|--------|-----------------|------------------------------------|-------------------------------|
| Male   | 85              | 60                                 | 70.5                          |
| Female | 73              | 45                                 | 61.6                          |
| Total  | 158             | 105                                | 66.4                          |

\*: Positive bacterial culture: The number of colonies on culture media were more than ( $10^5$  bacterial cells/ ml) according by (Finegold & Baron, 1986).

**Figure 2**

Table 2: Numbers and percentages of bacterial uropathogens isolated from positive cases of urinary tract infections

| Causative bacteria      | Male                 |      | Female               |      | Total            |                              |
|-------------------------|----------------------|------|----------------------|------|------------------|------------------------------|
|                         | No. of +ve cases(80) | %    | No. of +ve cases(45) | %    | No. of +ve cases | % from total +ve cases (105) |
| <i>Escherichia coli</i> | 42**                 | 70   | 30                   | 66.6 | 72               | 68.5                         |
| <i>Proteus</i>          | 18                   | 30   | 9                    | 20   | 27               | 25.7                         |
| <i>Klebsiella</i>       | 21                   | 35   | 13                   | 28.8 | 34               | 32.3                         |
| <i>Pseudomonas</i>      | 49                   | 81.6 | 39                   | 86.6 | 88               | 83.8                         |
| <i>Staphylococci</i>    | 27                   | 45   | 22                   | 48.8 | 49               | 46.6                         |
| <i>Streptococci</i>     | 8                    | 13.3 | 7                    | 15.5 | 15               | 14.2                         |

\*\*\* : The differences between existence of bacterial uropathogens in positive cases of U.T.I<sub>s</sub> are significant ( P < 0.01)

**Figure 3**

Table 3: Types of cell present in urine of male and female patients with urinary tract infections.

| Types of cell    | Number of specimens (%) |              |                   |              |                   |              |
|------------------|-------------------------|--------------|-------------------|--------------|-------------------|--------------|
|                  | Male (60 cases)         |              | Female (45 cases) |              | Total (105 cases) |              |
|                  | +ve                     | * -ve        | +ve               | -ve          | +ve               | -ve          |
| R.B.Cs           | 20<br>(33.3)            | 40<br>(66.6) | 21<br>(46.6)      | 24<br>(53.3) | 41<br>(39)        | 46<br>(60.9) |
| Pus cells        | 56<br>(93.3)            | 4<br>(6.6)   | 42<br>(93.3)      | 3<br>(6.6)   | 98<br>(93.3)      | 7<br>(6.6)   |
| Epithelial cells | 47<br>(78.3)            | 13<br>(21.6) | 39<br>(86.6)      | 6<br>(13.3)  | 86<br>(81.9)      | 19<br>(18)   |

\*\*\*: The differences between positive and/ or negative specimens in male and female patients with U.T.Is are high significant (P< 0.01).

\*:-ve: normal value of cell in urine according by ( Raphael, 1976).

:+ve: diagnostic features for U.T.Is. or urinary syndroms.

**Figure 4**

Table 4: Cast type in urine specimens of male and female patients with urinary tract infections.

| Types of Cast       | Males (60 cases) |      | Females (45cases) |      | Total (105cases) |      |
|---------------------|------------------|------|-------------------|------|------------------|------|
|                     | No. of cases     | %    | No. of cases      | %    | No. of cases     | %    |
| Ephelial cell Cast. | 13               | 21.6 | 22                | 48.8 | 25               | 23.8 |
| R.B.Cs. Cast.       | 9                | 15   | 11                | 24.4 | 20               | 19   |
| Pus Cells Cast.     | 27               | 45   | 26                | 57.7 | 53               | 50.4 |
| Hyaline Cast.       | 23               | 38.3 | 14                | 31.1 | 38               | 36.1 |
| Granular Cast.      | 20               | 33.3 | 18                | 40   | 37               | 35.2 |
| Others Cast.        | 6                | 10   | 6                 | 13.3 | 12               | 11.4 |

\*\*\*: The differences between types of cast in male and female patients urine are high significant (P < 0.01).

**Figure 5**

Table 5: Types of crystal in urine of male and female patients with urinary tract infections.

| Types of Crystal           | Males (60 cases) |      | Females (45cases) |      | Total (105cases) |      |
|----------------------------|------------------|------|-------------------|------|------------------|------|
|                            | No. of cases     | %    | No. of cases      | %    | No. of cases     | %    |
| Uric acid crystal.         | 16***            | 26.6 | 11                | 24.4 | 27               | 25.7 |
| Calcium oxalate crystal.   | 25               | 41.6 | 12                | 26.6 | 37               | 35.2 |
| Amorphous urate crystal.   | 29               | 48.3 | 18                | 40   | 47               | 44.7 |
| Sodium urate crystal.      | 12               | 20   | 7                 | 15.5 | 19               | 18   |
| Ammonium urate crystal.    | 9                | 15   | 3                 | 6.6  | 12               | 11.4 |
| Calcium phosphate crystal. | 21               | 35   | 15                | 33.3 | 36               | 34.2 |
| Others                     | 7                | 11.6 | 11                | 24.4 | 18               | 17.1 |

\*\*\*: The differences between types of crystal in male and female patients urine are high significant (P < 0.01).

**DISCUSSION**

The populations at risk for urinary tract infections include the newborn, particularly the premature, prepubertal girls, young boys, sexually active young women, elderly males, elderly females (Neu, 1992, and Ross&Kay, 1999).

Urinary tract infection is a result of interaction between a uropathogen and the host. Increased bacterial virulence appears to be necessary to overcome strong host resistance, and conversely, bacteria with minimal virulence are able to infect patients whose immunity is significantly compromised. Most bacteria enter the urinary tract from the fecal reservoir via ascent through the urethra into the bladder ( Hochreiter & Bushman, 1999, and Madersbacher, et al., 2000).

The present study showed a high percentage of U.T.I in males (70.5%) more than that found in females (61.6%), these results confirmed the results of other studies (Clarke, et al., 1985; Boscia, et al., 1986; Johnson, 1989; AL-Saimary, 1998; Kino & Kobayashi, 1999; Bombieri, et al., 1999; Tambyah & maki, 2000, and Wennerstorm, et al., 2000).

While some counter studies such as (Walsh, et al., 1998; and Madersbacher et al., 2000) suggested that urinary tract infections are more common in women than in man except in the neonatal period. The prevalence in young women is 30 times more than in men. However, with increasing age the ratio of women to men with bacteriuria progressively decrease, and the prevalence of bacteriuria also increases with institutionalization or hospitalization and current disease.

The present study also revealed a significant presence of R.B.Cs, pus cells and epithelial cells in total percentages (39%, 93.3% and 81.9%) respectively in positive cases of UTI and the percentages of these cells were biggest in females than those of males. A greater number of leukocytes generally indicates infection or inflammation in the urinary tract. Epithelial cells are commonly observed in the urinary sediment, squamous cells are frequently detected in female urine specimens and are derived from the lower portion of the urethra, the trigone of post pubertal females and the vagina. (Raphael, 1976 ; and Tanagho, etal ., 1995).

Also we found variation in the presence of various types of casts in infected males & females. These results may reflect variations in metabolic pathway activity and types of UTI. (Haber et al., 1979; Cushner et al., 1989). A cast is a protein coagulum that is formed in the renal tubule and traps any

tubular luminal contents within the matrix. Tamm-Horsfall mucoprotein is the basic matrix of all renal casts, it originates from tubular epithelial cells and is always present in the urine (Walsh et al., 1998). R. B. C casts & pus cell casts are seen in acute glomerulonephritis and pyelonephritis. Granular and waxy casts result from further degeneration of cellular elements and are indicative of nonspecific renal damage ( Kumar & Muchmore, 1990).

In our study we found various types of crystals in different percentages in the urine of infected males and females, these variations of presence may be due to the chemical nature and constituents of urine, and nutritional requirements of patients, and the use of antimicrobial agents for UTI. ( Haber, 1988; Schrier & Gottschalk, 1997 and Wennerstrom et al., 2000). Many previous studies concluded crystals that precipitate in acidic urine include calcium oxalate, uric acid, and cystin. Crystals that precipitate in an alkaline urine include calcium phosphate and triple-phosphate (struvite) crystals, and all types of these crystals may be indicative of renal calculi (stone) as well as urinary tract infections(Walsh et al., 1998;Theis et al.,2000and Riccabona, 2000).

## **IN CONCLUSION**

We believe that the cytological examination of urine is a significant tool in the diagnosis of urinary tract infections in male and female patients, because a strong relationship exists between positive results of the cytological and bacteriological studies.

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