

# SEED Urinalysis

Sysmex Educational Enhancement and Development  
February 2012

## Chronic Pyelonephritis

The urine sample from a patient in the orthopaedic department arrives in the laboratory with the request for urinalysis. The test strip results show abnormal values for glucose, protein and haemoglobin with otherwise normal results: glucose is found to be 50 mg/dL in the urine, protein is positive at 75 mg/dL and haematuria is indicated with a haemoglobin result of 150 mg/dL. The subsequent particle

count on the UF-1000i indicates erythrocyturia with 76.7 RBC/ $\mu$ L with some small red blood cells, and this is accompanied by mild leukocyturia with 28.8 WBC/ $\mu$ L, together with a moderately raised bacterial count. A significantly raised SRC result of 20.3/ $\mu$ L is noted, demonstrating the presence of small round cells in the urine.

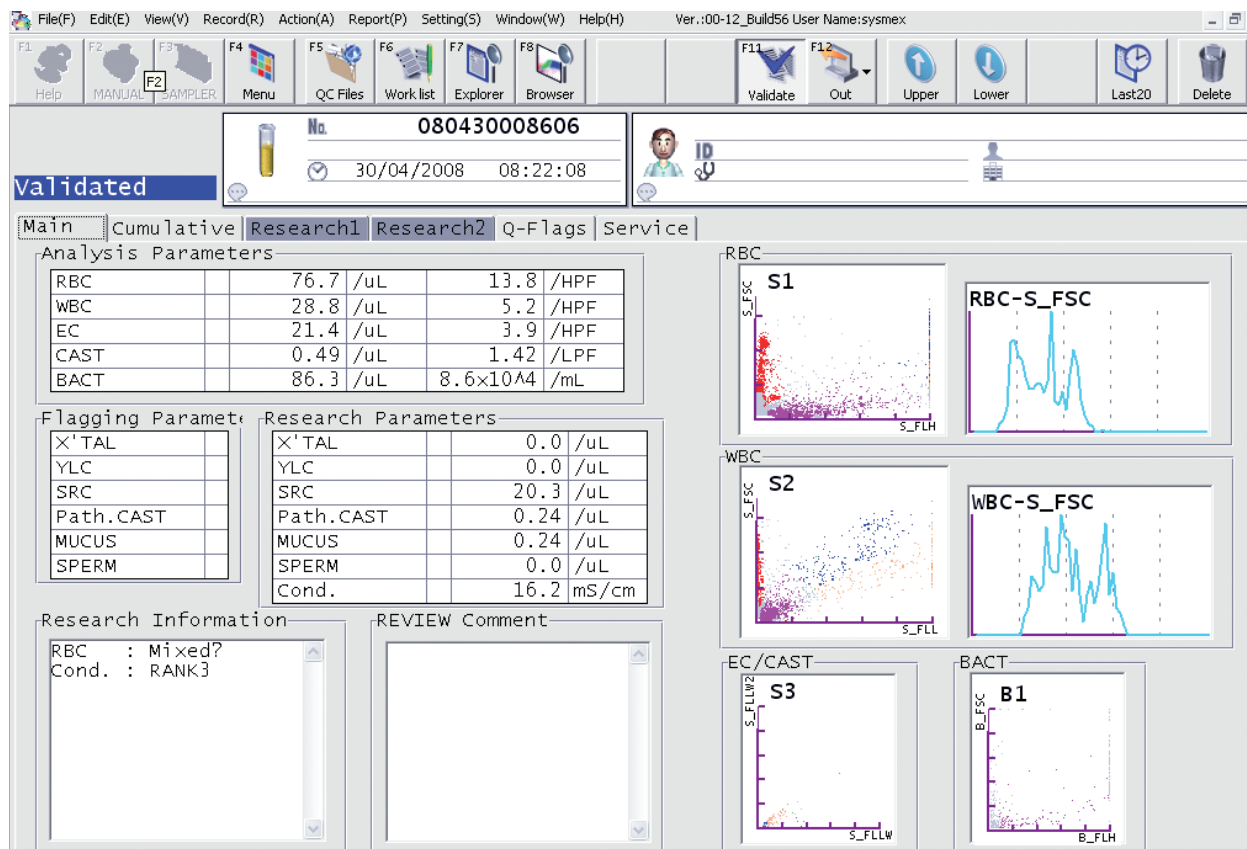
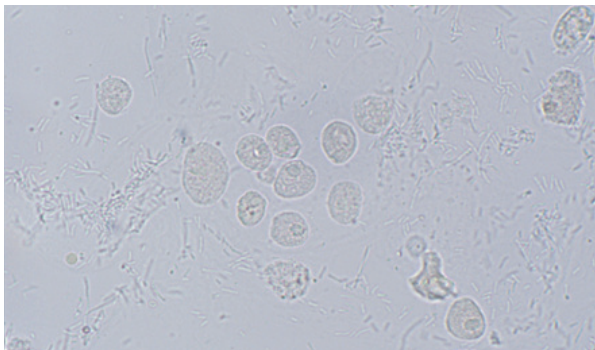


Fig. 1 Result of the particle count on the UF-1000i



**Fig. 2** Round epithelial cells on microscopy of the urine sediment

The sediment is prepared for examination of the red blood cell morphology and possibly further differentiation of the small round cells. The indication by the UF-1000i of some small red blood cells is confirmed by the finding of microcytic red blood cells in the urine sediment but without the presence of dysmorphic forms. The small round cell result on the UF-1000i is based on the presence of 4–5 renal epithelial cells/visual field and isolated urothelial cells, which can be seen beside the red blood cells, white blood cells and bacteria.

The clinical chemistry tests show slightly raised serum levels for urea (60 mg/dL), creatinine (1.5 mg/dL) and glucose (1+). The ESR is highly elevated (50 mm/h) as is the CRP (1.5 mg/dL). A follow-up request for the  $\alpha$ -1-microglobulin from this patient's urine yields a raised level of 120 mg  $\alpha$ -1 microglobulin/g creatinine. On ultrasound, one of the kidneys appears shrunken and hyperechoic. Scarred contractions and a thickened pyelic wall with slightly blurred renal architecture can be seen, which together with the laboratory results confirm the suspicion of chronic pyelonephritis.

### The condition of chronic pyelonephritis

Chronic pyelonephritis is damage to the renal interstitium and tubule cells due to inflammation. Untreated, it can lead to an increasing loss of renal function and a need for dialysis. Chronic pyelonephritis originates from bacterial, mycotic or viral infections that either persist subliminally or can occur again and again due to promoting factors. The promoting factors include malformations and outflow obstruction in the urogenital tract (e.g. due to calculi, tumours, prostatic hyperplasia or during pregnancy), an increased tendency to

infection, vesico-ureteric reflux and bladder catheters. Chronic pyelonephritis sometimes has few symptoms and may even be completely asymptomatic. Any symptoms are very non-specific. Apart from lassitude, anorexia, headache, subfebrile temperatures or hypertension, dull back pain may occur. In the present case, the condition was discovered incidentally by the routine request for urinalysis by the orthopaedic department.

### Diagnosis

The diagnosis of chronic pyelonephritis is made from overall consideration of the urine and serum analysis results and from imaging investigations.

### Urinalysis

There is often proteinuria and more or less marked haematuria. The signs of inflammation or infection are apparent in the usually moderately raised white blood cell and bacterial counts in the urine. Renal cells and tubule cells along with transitional epithelial cells are present in the sediment. Granulocyte casts are not always found. An elevated  $\alpha$ -1-microglobulin value indicates tubular dysfunction. The low molecular weight protein with its molecular weight of 33,000 Daltons is normally filtered in the glomerulus and then reabsorbed in the proximal tubule. If the tubule is damaged, as in the case of chronic pyelonephritis, where tubular atrophy is found, a raised level of  $\alpha$ -1-microglobulin is found in the urine.

Urine culture often does not show significantly raised bacterial counts but rather microbial counts in the grey area between  $10^4$ – $10^5$  CFU/mL, and this even without other factors lowering the bacterial count result, such as polyuria or already instituted antibiotic therapy.

### Serum levels

A frequently elevated CRP and elevated ESR also indicate an inflammatory process. Leukocytosis is seen in the blood count. A raised urea level in the serum indicates impaired excretion by the kidneys, which is caused by the inflammation of the renal tissue. Simultaneous elevation of the creatinine is also an indication of renal damage, provided the level does not turn out to be raised by the patient's muscle mass.

### **Ultrasound**

Ultrasound shows either one or both kidneys shrunken, with the distinction between cortex and medulla increasingly abolished. The echogenicity of the kidneys is increased and the kidneys demonstrate an irregular surface due to multiple scarred contractions of the parenchyma.

### **Histopathology**

Renal biopsy in chronic pyelonephritis would show foci of lymphocytes, plasma cells and histiocyte infiltrates in the renal interstitium. Apart from tubular atrophy and tubular and glomerular fibrosis, preserved tubules are found with a flattened layer of epithelium and protein deposits, sometimes with a bigger diameter. Collapsed capillary loops are found in the visible glomeruli.

### **Treatment**

The persistent or recurrent infections require targeted and sufficiently prolonged antibiotic therapy according to the microbial culture and sensitivity. Long-term treatment with antibiotics may be necessary. At the same time, the promoting factors must be treated or eliminated, where possible. However, the best treatment remains prevention, where promoting factors are recognised and treated as soon as possible and an infection that has occurred for the first time is cured successfully.

