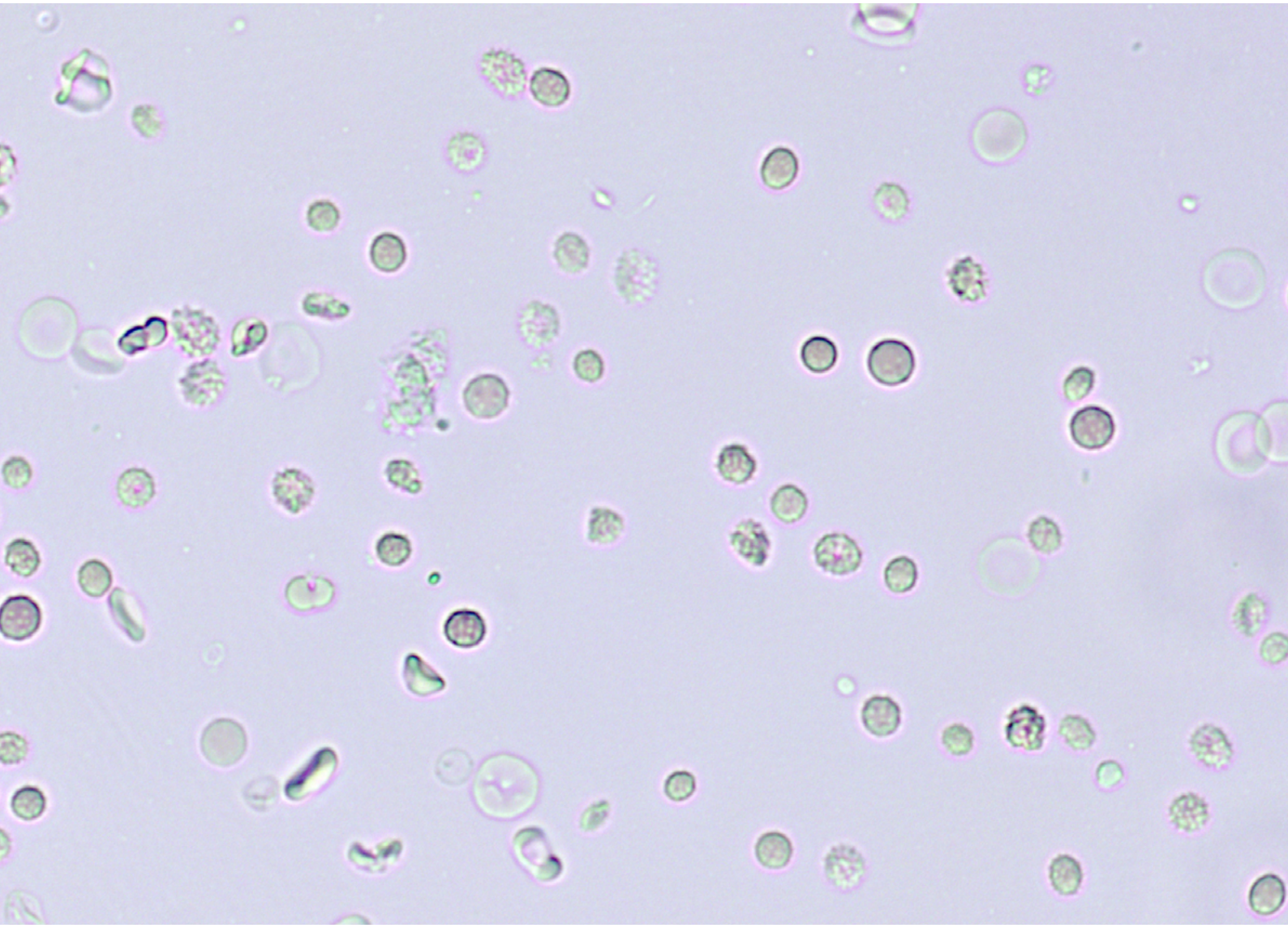
Application Note



Light Microscopic Analysis of Urine

ZEISS Primo Star and ZEISS Axio Lab.A1

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Light Microscopic Analysis of Urine

ZEISS Primo Star and ZEISS Axio Lab.A1

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Date: August 2015

A microscopic examination is part of medical laboratory routine to analyze whether there are abnormalities in the physical or chemical examination of urine. Cells, crystals and other substances are reported and counted. An urinalysis of the urine sediment is typically performed in brightfield and phase contrast. It can reveal diseases such as diabetes mellitus, various forms of glomerulonephritis, and chronic urinary tract infections.

Steps of Urinalysis

a) Visual analysis

Color, smell and appearance [Fig. 1] of fresh urine is first inspected visually. In general urine is yellow or amber in color and clear. Any turbidity or cloudiness may be caused by cellular material or protein in the urine or may develop from crystallization or precipitation of salts. Inserting a small amount of acid indicates that precipitation of salts is the probable cause of tubidity. An abnormal color could be sign of a special diet, a drug, or the presence of either hemoglobin or myoglobin.

b) Chemical analysis

The chemical examination of urine is mostly carried out using commercially prepared test strips the so called dipsticks. These are plastic strips that hold small squares of paper impregnated with chemicals. When the strip is dipped into urine, a chemical reaction changes the color of the paper squares. The color change is compared to a color chart provided with the test strips to determine the result for each test [Fig. 2]. The most frequently performed chemical tests using reagent test strips are: specific gravity, pH-value, protein, glucose, ketones and blood.

Figure 1: Visual investigation of urine

Figure 2: Chemical analysis of urine

c) Microscopic analysis

A microscopic analysis is typically performed to visualize blood cells, epithelial cells and pathogens, for example, when there are abnormal findings on the visual or chemical analysis. A sample of usually 10 – 15 ml urine is centrifuged to concentrate the substances in it at the bottom of a tube [Fig. 3]. The fluid at the top of the tube is then discarded and the remaining sediment is examined under a microscope [Fig. 4 & 5].

Figure 3 *Preparing the urine sample for the centrifuge*

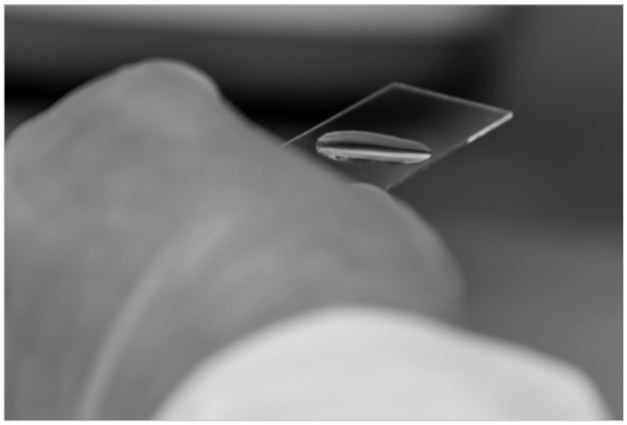

Figure 4 *Preparing the glass slide for light microscopic examination*

Urine sediment is normally examined with a transmitted light microscope with brightfield or phase contrast [Fig. 5]. Visualizing crystals' polarization contrast can be helpful. The sediment is first examined with low magnification to identify most crystals, casts, squamous cells, and other large objects. Next, examination is carried out at high magnification to identify crystals, cells, and bacteria. All findings are counted and reported.

Figure 5 *Examination of urine with ZEISS Primo Star*

Application examples

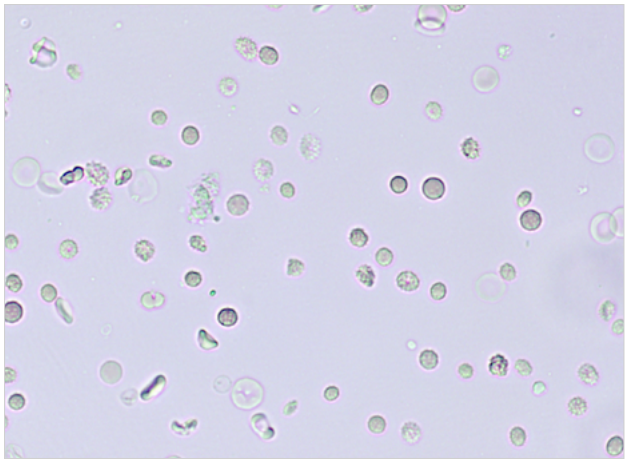

Figure 6 *Erythrocytes (red blood cells) in urine showing thorn apple shape because of non-physiological pH-value of the urine*
Courtesy of: A. Michelsen, Clinic of Ortenau, Germany

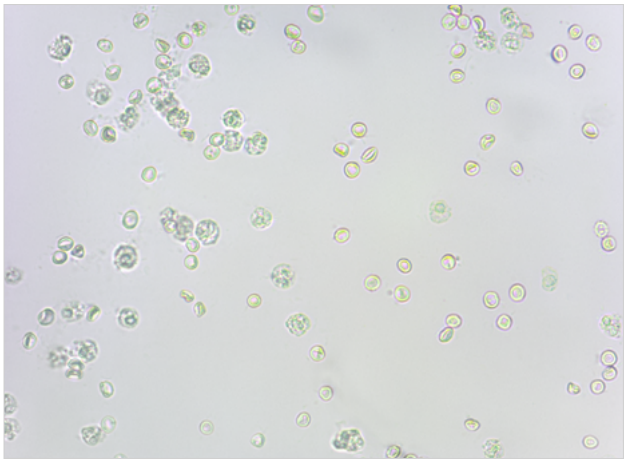

Figure 7 *Erythrocytes and leukocytes (white blood cells) in urine*
Courtesy of: G. Spengler-Schulz, Alexander Fleming School, Stuttgart, Germany

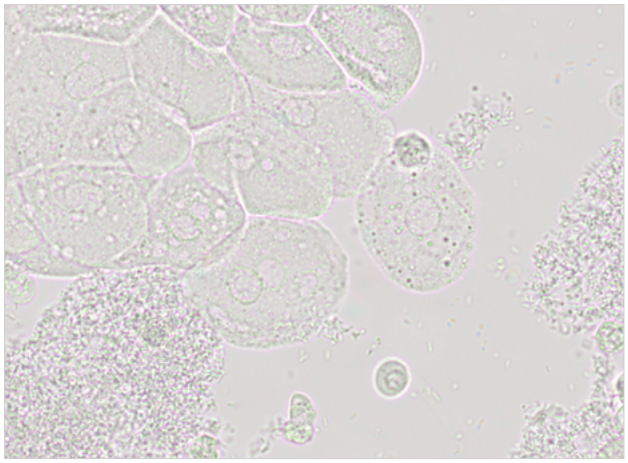

Figure 8 *Squamous epithelial cells*
Courtesy of: A. Michelsen, Clinic of Ortenau, Germany

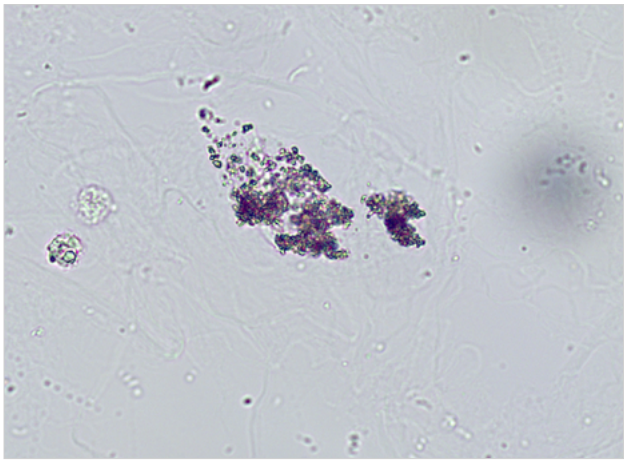

Figure 9 *Salts on a cylindrical structure*
Courtesy of: A. Michelsen, Clinic of Ortenau, Germany

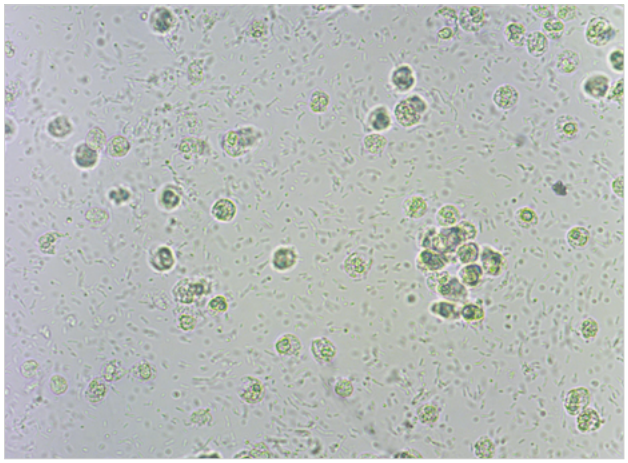

Figure 10 *Bacteria and Leukocytes. Bacteria are common in urine specimens.*
Courtesy of: G. Spengler-Schulz, Alexander Fleming School, Stuttgart, Germany

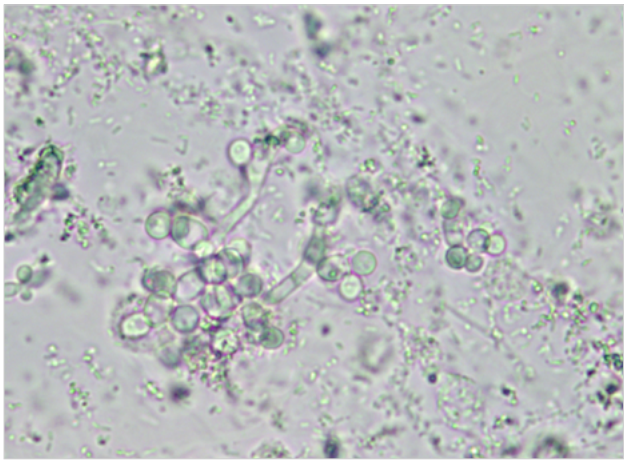

Figure 11 *Fungus mycelium with yeast cells. Yeast cells may be contaminants or represent a true yeast infection.*
Courtesy of: A. Michelsen, Clinic of Ortenau, Germany

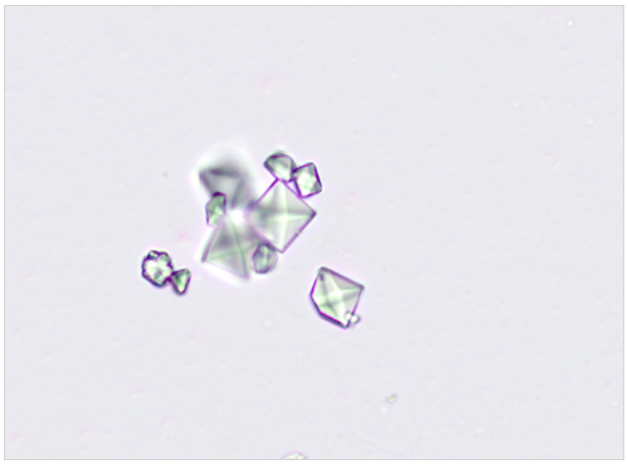

Figure 12 *Calcium oxalate in urine. Crystalluria indicates that the urine is supersaturated with the compounds that comprise the crystals, e.g. ammonium, magnesium and phosphate for struvite.*
Courtesy of: A. Michelsen, Clinic of Ortenau, Germany

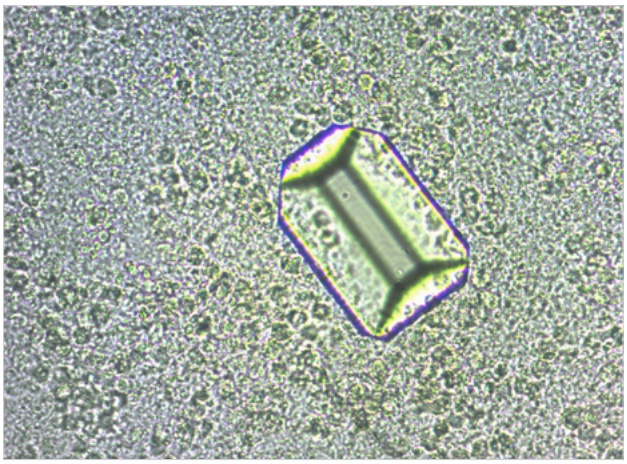

Figure 13 *Triple phosphate in urine*
Courtesy of: G. Spengler-Schulz, Alexander Fleming School, Stuttgart, Germany

Conclusion

The urinalysis is used as a screening tool to detect substances or cellular material in the urine associated with different metabolic and kidney disorders. A microscope with bright-field and phase contrast such as Primo Star and Axio Lab.A1 is the recommended tool as transparent elements in the urine will be clearly visible.

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