Review

Prostate-Specific Antigen: Current Status

(prostate-specific antigen / tumor markers / prostate cancer / benign prostatic hyperplasia)

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Abstract. PSA is the most important of all tumor markers because it has significant applications in all aspects of the management of men with prostatic disease. Certainly, the most important utilization of PSA is for early detection of this most ubiquitous of all human neoplasms.

In this article the authors describe the molecular forms of PSA and their characteristics, the factors influencing values of serum concentration of PSA, the problems of screening, and particularly the possibility to use PSA for detection of prostate carcinoma. A big problem in prostate carcinoma detection is the low specificity of PSA at the concentrations between 4–10 ng/ml, the so-called diagnostic gray zone, where the incidence of prostate carcinoma is only 25%. The authors evaluate the methods which make it possible to increase the sensitivity and/or specificity of PSA detection, such as PSA density, PSA density of the transition zone, PSA velocity, PSA doubling time, age-specific PSA, free PSA and, prospectively, the use of the RT-PCR technique.

Nearly 20 years have passed since prostate-specific antigen (PSA) was definitively identified. Throughout this period, its clinical application as a tumor marker has expanded significantly. Today, besides monitoring prostate cancer therapy, PSA is being used extensively in mass screening programs for early detection of adenocarcinoma of the prostate and has become the most important tumor marker in urologic oncology.

Its discovery has often been attributed to Wang (1979) but PSA was identified for the first time in prostatic tissue by Ablin et al. in 1970(a, b). In 1971, Hara et al. described γ-seminoprotein in sperm when they tried to discover a marker for use in forensic medicine to identify rape perpetrators. Later it was shown that this substance was identical with PSA. PSA was purified and characterized using gel electrophoresis by Wang et al. in 1979.

Since the time when PSA started to be widely used in PC diagnostics, the number of examinations by transrectal ultrasonography (TRUS) and prostate biopsy has significantly risen. This resulted in higher detection of PC and in an increasing number of patients treated for PC (Jacobsen et al., 1995). Testing of PSA has also moved the detection of PC from advanced to earlier stages.

Characterization and molecular forms of PSA

The prostate-specific antigen (Fig. 1) is present as a form of human kallikrein, a glycoprotein with the molecular weight of 33 kDa and with the activity of neutral serine protease. Its molecule is formed by 237 amino acids and one hydrocarbon chain bound to the amino group of aspartic acid. Of the overall molecular mass, 93% are represented by amino acids and 7% by saccharides. PSA has several isoforms and its isoelectric point lies in the range 6.8–7.2. At the temperature –20°C, it is possible to store the serum for PSA detection without affecting later

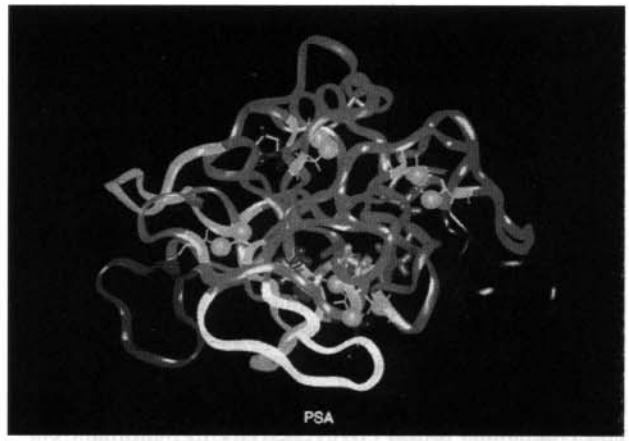

Fig. 1. Prostate-specific antigen

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Abbreviations: BPH – benign prostatic hyperplasia, DRE – digital rectal examination, PC – prostate cancer, PSA – prostate-specific antigen.