Variation of Angiotensin-Converting Enzyme Activity in Spermatozoa of Patients with Chronic Prostatitis and Chernobyl Cleanup Workers

V. V. Evdokimov, E. N. Atochina, and I. Yu. Sakharova

UDC 616.154:579.175.852] – 02:[616.65 – 002.2] + 614.876] – 07

Translated from *Byulleten' Eksperimental'noi Biologii i Meditsiny*, Vol. 115, No. 6, pp. 620–621, June, 1993
Original article submitted February 9, 1993

Key Words: *angiotensin-converting enzyme; spermatozoa; chronic prostatitis; irradiation*

Angiotensin-converting enzyme (ACE) is a zinc-dependent carboxydipeptidase playing a key role in blood pressure maintenance by catalyzing the reaction of angiotensin I hydrolysis with the formation of the potent vasoconstrictor angiotensin II and the inactivation of bradykinin [1,3,4]. ACE has been found in and isolated from various tissues and biological fluids, such as the lungs, kidneys, brain, heart, liver, blood serum, and sperm [5,8-11]. An in-depth study of the ACE molecule has demonstrated the existence of at least two isoenzymes. While the pulmonary ACE isoenzyme is sufficiently well studied at present; in contrast, papers on the testicular isoenzyme are relatively few, and the problem of its physiological role is still to be researched.

At present the method of measuring serum ACE activity is diagnostically important, primarily with regard to such diseases as sarcoidosis, silicosis, Gaucher's syndrome, diabetes, and thyroid and pulmonary diseases [6,7]. There are no published studies on the diagnostic use of testicular ACE measurements, although indirect evidence of the usefulness of this test can be found. The present paper presents the results of ACE activity measurements in human spermatozoa and sperma which revealed deviations from the normal range of values in sperm of patients with chronic prostatitis and of Chernobyl cleanup workers.

Institute of Urology, Ministry of Health of the Russian Federation; Chemical Faculty of the M. V. Lomonosov Moscow State University. (Presented by N. A. Lopatkin, Member of the Russian Academy of Medical Sciences)

MATERIALS AND METHODS

Ejaculates of patients with chronic prostatitis and Chernobyl cleanup workers were obtained during their examination at the Institute of Urology of the Ministry of Health of the Russian Federation. The control group consisted of donors at the Family and Marriage Counseling Center. Ejaculate samples were examined according to the WHO recommended standard method [12]. The samples were obtained by masturbation after a 3-5 day abstinence. Testing was carried out after dilution of the ejaculate. For measurement of ACE activity in patients' ejaculate samples 1 ml of the material was taken within 30 min after the samples were obtained and centrifuged at 2000 rpm for 20 min at 0°C. The resultant spermoplasma was frozen and stored at -18°C. The sediment was carefully resuspended in normal saline (20×10^6 spermatozoa/ml) and then resultant cell suspension was recentrifuged as before. The supernatant was discarded and 100 μl of normal saline was added to the sedimented spermatozoa and they were frozen at -18°C. The samples were stored at this temperature till the enzymatic activity measurements. The ACE levels were measured directly after defrosting the samples

0007-4888/93/0006-0693$12.50

TABLE 1. Angiotensin-Converting Enzyme Activity in Human Ejaculate and Spermatogenesis Level

	Donors	Chernobyl cleanup workers	Chronic prostatitis patients
Number of subjects	9	13	7
Ejaculate volume, ml	2.7±0.3	3.6±1.0	2.5±0.7
Spermatozoa count, mln/ml	167±68	58±24	59±21
Live	80±6	73±11	74±4
Abnormal forms	26±6	57±9	50±10
Active mobile spermatozoa, %	48±7	23±11	23±18
Poorly mobile spermatozoa, %	12±4	30±8	22±13
Spermatogenesis cells	2±0.8	3±1.3	2.5±0.6
ACE activity in spermatozoa, milliU/mln cells	3.1±1.5	39.7±3.5	21.5±7.1
Spermoplasma, milliU/ml	6310±2000	6815±2000	5230±1355

at room temperature because otherwise the resultant values were significantly reduced, as was demonstrated in a special experiment. ACE activity was measured as described previously [2] with Bz-Gly-His-Leu used as a substrate. Before enzymatic activity was measured the blood and spermoplasma samples were diluted tenfold with 0.15 M NaCl and the spermatozoa samples were diluted 50 times.

RESULTS

The examination of Chernobyl cleanup workers revealed deviations in the sexual sphere of almost one-third of patients exposed to doses from 0.2 to 25 sGy. These deviations were reduced libido, incomplete erection, and premature ejaculation. Analysis of spermatogenesis in the three groups (Table 1) showed the most severe disorders in the cleanup workers: the share of live spermatozoa was reduced and the counts of abnormal sperm forms increased, as was the count of spermatogenesis cells. The share of live spermatozoa was reduced in patients with chronic prostatitis, too, while the other parameters showed less marked changes.

Measurements of spermoplasma ACE activity revealed no noticeable differences between donors and patients (Table 1). Blood serum ACE concentrations were the same in both as well; in contrast, a drastic increase of ACE activity vs. the norm was observed in spermatozoa of the cleanup workers (10-fold, as estimated per 10^6 cells) and of chronic prostatitis patients (7-fold). The causes of the detected specific ACE activity increase in spermatozoa of patients with chronic prostatitis and of Chernobyl workers are not clear. Still, the phenomenon is likely to become of diagnostic importance in the assessment of male reproductive system function. We hope that our future research will shed light on the physiological role of testicular ACE isoenzyme.

REFERENCES

1. Yu. B. Eliseeva, V. I. Orekhovich, L. V. Pavlikhina, *et al.*, *Vopr. Med. Khim.*, No. 6, 646-649 (1970).
2. I. Yu. Sakharov, E. A. Dukhanina, and S. M. Danilov, *Biochimiya*, **51**, 946-951 (1986).
3. P. Bunning and J. F. Riordan, *Metabolic Interconversion of Enzymes: International Tissue Conference*, Ed. H. Holzer, Berlin, pp. 248-256.
4. D. W. Cushman and M. A. Ondetti, *Prog. Med. Chem.*, **17**, 42-104 (1980).
5. E. G. Erdos and R. A. Skidgel, *Biochem. Tran. Soc.*, **13**, 42-44 (1985).
6. J. Liberman and E. Beutler, *New Engl. J. Med.*, **294**, 1442-1444 (1976).
7. J. Liberman and A. Sastre, *Ann. Intern. Med.*, **93**, 825-826 (1980).
8. I. Yu. Sakharov, S. M. Danilov, and E. A. Dukhanina, *Biochim. Biophys. Acta*, **923**, 143-149 (1987).
9. I. Yu. Sakharov, S. M. Danilov, and N. V. Sukhova, *Analyt. Biochem.*, **166**, 14-17 (1987).
10. H. Taira, S. Mizutani, O. Kuraichi, *et al.*, *J. Chromatogr.*, **339**, 339-403 (1985).
11. J. A. Weare, J. T. Gafford, H. S. Lu, and E. G. Erdos, *Analyt. Biochem.*, **123**, 310-319 (1982).
12. *WHO Laboratory Manual for the Examination of Human Semen and Semen-Cervical Mucus Interaction.* New York (1987).