

## Serum-Zn-levels in prostatic cancer

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**Summary.** Zinc in serum of both patients with prostatic carcinoma and men without prostatic cancer was analyzed by flame atomic absorption spectrometry (FAAS). No significant differences were found between the group with prostatic carcinoma without metastasis and the group used for comparison. The Zn level in serum of patients with both prostatic carcinoma and metastases was decreased in comparison to the other groups. A decrease in the Zn concentration was also found for men without metastases after orchiectomy and hormone therapy.

**Key words:** Prostatic carcinoma – Metastasis – Zn concentration in plasma – Hormone therapy

### Introduction

The normal human prostate is characterized by a high Zn level compared with other organs. The Zn concentration of the prostatic tissue is markedly decreased in carcinomatous prostates and is increased in BPH [2, 4, 5]. Zn determination in prostatic tissues is not helpful in the diagnosis of cancer. The concentration of trace elements, especially Zn, Cd, Se, Cu and Mn, in whole blood, urine and plasma has been studied, in search of markers for the diagnosis of several internal and urological diseases [1, 7]. The importance of plasma Zn for the early diagnosis of BPH was also discussed [8]. Others have studied the concentration of Cu, Zn and the leucocyte status in tumors of the prostate [6].

As a result of previous investigations of the zinc and cadmium level in plasma and in erythrocytes we stated that the plasma Zn concentration is not a useful index for BPH nor for both prostatic and other urological tumors [3]. We found small differences in the Zn concentration in erythrocytes of men with BPH compared to normal patients and also between normal patients and a prostatic carcinoma group. These differences were insufficient for diagnosis. In this paper we have

recorded – as a follow-up to the previous work – the results of our studies to the serum zinc level of men with prostatic carcinoma and metastases compared with patients with prostatic carcinoma without metastases. In addition the Serum-Zn-level before and after orchiectomy and hormonal therapy was investigated.

### Materials and methods

The blood samples were obtained from 75 men:

- 50 cases with prostatic carcinoma without metastases (19 adenocarcinoma, 20 solid carcinoma, 11 poorly-differentiated carcinoma); (average age: 69)
- 15 cases with metastatic prostatic carcinoma (average age: 71)
- 10 patients without prostatic carcinoma for comparison; (average age: 66)

The diagnosis was made histologically by perineal biopsy.

The blood samples were taken before and one day after orchiectomy and after 10 days of hormone therapy (after an overnight fast). Blood collected using a plastic disposable syringe was stored in polypropylene tubes. The serum was separated by centrifugation. Plasma and trichloroethylenic acid (10 vol%) were mixed in a ratio of 1:1; protein was separated by centrifugation. The solutions were analyzed with flame atomic absorption spectrometry (403 Perkin Elmer Corp.) at 213.9 nm. The relative standard deviation obtained

**Table 1.** Zn concentration in serum of patients with prostatic carcinoma before orchiectomy and hormone therapy

Group	n	Average age	Serum Zn (μmol/l)
Carcinoma without metastases	50	68,6	14.0 ± 1.9
adenocarcinoma	19		13.8 ± 1.7
solid	20		14.5 ± 1.4
poorly-diff.	11		13.5 ± 1.8
Carcinoma with metastases	15	71.5	9.9 ± 1.0
Normal	10	65.9	13.9 ± 1.9

**Table 2.** Zn concentration in serum of patients with prostatic cancer after castration and hormonal therapy

Group	n	Zn concentration ( $\mu\text{mol/l}$ )		
		before orchiectomy	one day after orchiectomy	after 10 days with hormone therapy
Carcinoma without metastases	50	$14.0 \pm 1.9$	$14.4 \pm 1.8$	$11.6 \pm 2.4$
Carcinoma with metastases	15	$9.9 \pm 1.0$	$10.0 \pm 1.1$	$10.7 \pm 1.2$

for the determinations of Zn using flame AAS varied between 1 and 5%.

## Results

Table 1 summarizes the serum Zn concentrations and patient data. As can be seen from this table the Zn concentration in serum of patients with metastases was significantly decreased in comparison to the other groups. No differences between the normal group and the carcinoma without metastases could be found confirming our previous results [3]. The Zn serum levels of the normal group, were correlated to values given in the literature [9]. Although the Zn levels in carcinomatous tissues of the prostate were significantly lower than those of normal patients we were unable to correlate the Zn-serum levels in similar manner to the Zn concentration in plasma and erythrocytes [3], which varied with the pathological condition of the gland.

The decrease of the Zn-serum levels from men with progressive metastatic carcinoma could be influenced by the disturbed Zn-metabolism in connection with the enlargement of the tumour.

On the first day after orchiectomy the Zn serum status had not changed for patients with and without metastases, as can be seen from Table 2. After an additional therapy with hormone (Hönvan) for 10 days (with 500 mg diethylenedioxystilben-diphosphate daily) the concentration of Zn was significantly decreased in serum of the patients without metastases, whereas no effects of the oestrogen therapy on the Zn – level of patients with metastases were found. Castration causes a positive anti-androgenic effect, which is increased with oestrogen therapy. Consequently we found a significantly lower Zn concentration in the serum of patients without metastases after orchiectomy and hormone therapy.

The differences between the two groups after both orchiectomy and hormone therapy were not discriminant.

## Conclusions

The biological importance of Zn lies in its role in the formation of Zn-containing enzymes, such as carbonic anhydrase, and also in protein synthesis.

The Zn-serum level is not significantly decreased one day after orchiectomy due to blood loss. Castration has a positive antiandrogenic effect, which is increased by oestrogen administration which might explain the significantly lower Zn concentration in the serum after orchiectomy and hormone therapy.

We assume that the growth of metastases was connected with the stimulation effect of new metastatic cells might result in an accumulation of considerable amounts of Zn. Decreased Zn-serum levels in patients with metastases ought to be observed subsequently, which would require confirmation by further studies.

## References

1. De Voogt RV, Hattern B, Feenstra JF, Copius-Pereboom JW (1980) Exposure and health effects of cadmium. *Toxicol Environ Chem Rev* 3:89–109
2. Feustel A, Wennrich R (1984) Zinc and cadmium in cell fractions of prostatic cancer tissues of different histological grading in comparison to BPH and normal prostate. *Urol Res* 12:147–150
3. Feustel A, Wennrich R (1986) Zinc and cadmium plasma and erythrocytes levels in prostatic carcinoma, BPH, urological malignancies, and inflammations. *Prostate* 8:75–79
4. Feustel A, Wennrich R, Steiniger D, Klauf P (1982) Zinc and cadmium concentration in prostatic carcinoma of different histological grading in comparison to normal prostate tissue and adenofibromatosis (BPH). *Urol Res* 10:301–303
5. Feustel A, Wennrich R, Ditttrich H (1987) Zinc, cadmium and selenium concentrations in separated epithelium and stroma from prostatic tissues of different histology. *Urol Res* 15:161–163
6. Habib FK, Dembinski TC, Stitch SR (1980) The zinc and copper content of blood leucocytes and plasma from patients with benign and malignant prostates. *Clin Chim Acta* 104:329–335
7. Versieck J, Cornelis R (1980) Normal levels of trace elements in human blood plasma or serum. *Anal Chim Acta* 116:217–254
8. Willden EG, Robinson MR (1975) Plasma zinc levels in prostatic disease. *Br J Urol* 47:295–299
9. Zunkley H, Vetter H, Bertram HP, Tank B, Wirth W (1980) Plasma zinc and magnesium alterations in acute myocardial infarction. *Klin Wochenschr* 58:1143–1146

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