

Publication is summarization of existing data being results of literature review and our experience on usefulness of selenium as a diagnostic marker selection for control examinations in surveillance and as a marker of patients with high risk of cancers.

Key words: selenium, marker of cancer risk, surveillance.

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Selenium as a marker of cancer risk and of selection for control examinations in surveillance

Marcin Lener¹, Magdalena Muszyńska^{1,2}, Anna Jakubowska^{1,2}, Katarzyna Jaworska-Bieniek¹, Grzegorz Sukiennicki¹, Katarzyna Kaczmarek¹, Katarzyna Durda¹, Tomasz Gromowski¹, Pablo Serrano-Fernández¹, Józef Kładny³, Anna Wiechowska-Kozłowska⁴, Tomasz Grodzki⁵, Ewa Jaworowska⁶, Jakub Lubiński⁶, Barbara Górecka-Szyl⁷, Grażyna Wilk⁷, Tomasz Huzarski¹, Tomasz Byrski¹, Cezary Cybulski¹, Jacek Gronwald¹, Tadeusz Dębniak¹, Olgierd Ashuryk¹, Aleksandra Tołoczko-Grabarek¹, Antoni Morawski^{2,8}, Rodney J. Scott⁹, Jan Lubiński^{1,2}

¹Department of Genetics and Pathology, International Hereditary Cancer Centre, Pomeranian Medical University, Szczecin, Poland

²Read-Gene SA, Grzeczka, Poland

³Department of General and Oncological Surgery, Pomeranian Medical University, Szczecin, Poland

⁴Laboratory of Endoscopy, Division of Health Care, Ministry of Internal Affairs and Administration in Szczecin, Poland

⁵Specialised Hospital for Lung Diseases, Szczecin-Zdunowo, Poland

⁶Department of Otolaryngology and Laryngological Oncology, Pomeranian Medical University, Szczecin, Poland

⁷Department of General and Dental Radiology, Pomeranian Medical University, Szczecin, Poland

⁸Institute of Inorganic Chemical Technology and Environmental Engineering, West Pomeranian University of Technology, Szczecin, Poland

⁹Discipline of Medical Genetics, School of Biomedical Sciences, Faculty of Health, University of Newcastle and The Hunter Medical Research Institute, Newcastle, New South Wales, Australia

Selenium as a marker of selection for control examinations in surveillance

There are literature data which clearly demonstrate that identification of low selenium levels can be useful in disease surveillance by such methods as computerised tomography for detection of lung cancers and in colonoscopy for detection of early stage colorectal cancers. More than 20 studies have shown that low serum selenium levels are related to an increased risk of lung cancer. Studies performed by our centre, which evaluated the level of selenium in the serum of 86 patients with lung cancer and 86 healthy controls, have also shown a strong correlation between selenium level and cancer. Among lung cancer cases, the mean selenium level was 63.2 µg/l compared to a mean level of 74.6 µg/l for their matched controls. A 10-fold reduced risk of lung cancer was also observed in individuals with serum selenium > 80 µg/l as compared to those patients whose serum Se levels were < 60 µg/l [1]. Between 2008-2011 in Szczecin – a single city of four hundred thousand inhabitants in North-West Poland – a programme for early detection of lung cancer was conducted. The enrolment criteria included both sexes, aged 55–65 years, who had a history of at least 20 pack-years of tobacco smoking. The latest addition to the protocol of this programme in 2012 was the inclusion of preselection of participants by measurement of their serum selenium levels. Only individuals with a low selenium level (< 75 µg/l) were invited for computerised tomography scans. This new addition to the protocol resulted in more than doubling the detection rate of lung cancers [2].

Table 1. The correlation between serum selenium level and the risk of cancers of different sites of origin

Cancer	Quartile	Selenium level ($\mu\text{g/l}$)	No. of cancer/controls	OR	p-value
Any except of breast cancers	I	< 65	22/16	1	–
	II	65–79	38/87	3.148	0.0036
	III	80–95	28/61	2.996	0.0094
	IV	> 95	3/21	9.625	0.0005

There are also about 10 studies that suggest a protective effect of selenium on colorectal adenoma/carcinoma development. In a Polish-Estonian study that evaluated the effect of selenium on the risk of colorectal cancer in 169 cancer cases and 169 healthy controls, a more than 13-fold increased risk of colorectal cancer was found in patients with serum Se levels < 40 $\mu\text{g/l}$ compared to patients whose serum Se levels were > 72 $\mu\text{g/l}$ [3].

Generally, there appears to be little doubt that low selenium level is associated with increased risk of cancer; however, the optimal serum selenium levels can be different for particular populations/countries. For example, in the U.S. the serum level of selenium associated with the lowest risk of colorectal adenomas is > 150 $\mu\text{g/l}$. Such differences between Europe and America can be related to several genetic and environmental factors including exposure to chemical compounds [4].

It is well recognised that for early colorectal cancer detection, colonoscopy is a well-established method for the detection of precancerous conditions and of early cancers. Screening studies using colonoscopy are not widely performed in the world as they are expensive and time consuming. It appears that pre-selection using data based on the levels of serum selenium may be useful in increasing the cost-effectiveness and specificity of detecting precancerous lesions occurring in the colon.

Further investigations are needed to determine the value of serum selenium levels as a selection marker for patient selection for prophylactic screening in other types of tumours, such as cancers of the stomach, pancreas, and prostate.

Selenium and cancer risk

Data from a meta-analysis of 49 prospective studies revealed that overall the risk of cancer incidence was 31% lower in the highest category of selenium exposure than in the lowest. Reduction of the number of new cases of cancers with optimised selenium concentration was observed for cancers of the: bladder, lung, larynx, prostate, stomach and colon [5].

In prospective cohort in our Polish centre we found similar correlation for non-breast cancers. In Table 1 we present results on prospectively found 95 cancer (including 19 prostate, 15 colorectal, 14 bladder, 11 lung cancers), matched (by sex, year of birth, cancer family history) 1 : 2 to unaffected individuals with a mean follow-up 19.4 months (range 3–45 months). A few-fold higher risk of cancer can be seen when serum selenium level is under 65 $\mu\text{g/l}$.

In summary, there exists significant evidence that selenium levels may be used as a marker for high cancer risk patient groups and in the selection of persons for appropriate screening and early detection of tumours.

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Address for correspondence

Marcin Lener

Department of Genetics and Pathology
International Hereditary Cancer Centre
Pomeranian Medical University
Połabska 4
70-115 Szczecin, Poland
phone +48 91 466 15 32
fax +48 91 466 15 33
e-mail: marcinlener@poczta.onet.pl