Selenium and its compounds in oncology: Prostata cancer

Accepted 7th March, 2018

ABSTRACT

In last years there have been some notable developments in several areas of inorganic pharmaceutical study that have the potential par-reaching importance for future medical applications. One of the highly significant developments in the field of oncology. Scientific opinion on the relationship between selenium and the risk of cancer has undergone radical change over the years. Prostate cancer is a key health concern for men with its etiology still under investigation. Much attention is especially for selenium supplement use and multivitamins and after diagnosis associated with risk of biochemical recurrence – prostate cancer.

Keywords: Selenium, prostate cancer, treatment.

INTRODUCTION

Medicinal chemistry is one of the most developing areas of pharmaceutical research. One of the fundamental goal in medicinal chemistry is the development of new anticancer and antimicrobial therapeutic agents. Selenium has attracted increasing interest in recent decades because of the function of regulating the redox balance in the human body. However, biomedical studies of selenium are still limited. Selenium as an essential micronutrient is known for its cancer prevention properties and is incorporated into a class selenocystein containing protein.

Organic selenium compounds have been documented to play a role in cancer chemoprevention (Lu et al., 2016). The current epidemiological evidence on selenium and human cancer risk was reviewed (Venceti et al., 2013).

Different biological effects of the various inorganic and organic chemical forms of selenium may explain apparent incomitanaces across studies. The selenium accumulates in tumors due to the selective permeability of the cancer cell membrane and selenium compounds. For this reason, a number of selenium compounds have been found for their anti-cancer activity.

SELENIUM AND ITS COMPOUNDS IN ONCOLOGY (PROSTATA CANCER)

As we gain a better understanding of the factors affecting etiology, we can design and improve treatment strategies. Over the past four decades, there have been numerous successful efforts in recognizing important cellular proteins essential in cancer growth and therefore these proteins have been targeted for cancer treatment, however, the study suggested a biologic interaction between alpha-tocopherol and selenium itself or selenomethionine.

Relation of selenium and vitamin E exposure to prostate cancer risk by smoking status was studied by Kim et al. (2015). They found that the association between vitamin E and prostate cancer is not modified by smoking. Selenium exposure is associated with lower prostate cancer risk among smokers, however, the lack of an association for current smokers indicate that this finding needs to be interpreted with caution.

A functional variant in an androgen-regulated prostate tumor suppressor protein in the presence of selenium and vitamin E was studied by Martiner et al. (2014). Their results indicate that variation in the protein expression combined with selenium or vitamin E treatment modifies the risk on prostate cancer.

Genetic background may modulate the effects of antioxidant supplementation thought to act as chemoprevention agents. The selenium and vitamin E related gene variants in the connection with supplementation interaction and risk of high-grade
prostate cancer was studied by Chan et al. (2016). They noted statistical significant interactions between selenium assignment and high-grade prostate cancer risk. Loeb et al. (2015) studied the extent at which genetic risk and prostate risk can be reduced. These associations were attenuated with the use of selenium supplements, aspirin, ibuprofen and higher vegetable intake. For selenium, the attenuation was most striking for advanced prostate cancer. This study suggests that selenium supplements may reduce genetic risk of advanced prostate cancer; rohote, aspirin, ibuprofen and vegetables may reduce genetic risk of non-advanced prostate cancer.

Dai et al. (2016) examined the in vitro effects of the selenium compounds, sodium selenite and selenomethionine on cholangiocarcinoma cell growth and migration to determine their potential usefulness as anticancer agents. Ilim et al. (2015) studied the relation of selenium and vitamin E exposure to prostate cancer risk by smoking status and found that the association between vitamin E and prostate cancer is not modified by smoking. Selenium exposure is associated with lower prostate cancer risk among ever-smokers, however, the lack of an association for current smokers indicate that this finding needs to be interpreted with caution.

The effect of both compounds on the selenoprotein M level was investigated and it was found that the compounds increased selenoprotein M protein in cholangiocarcinoma cells, which indicates that selenium may potentially be an alternative anticancer agent. Meplan et al. (2014) discussed the functional significance of single-nucleotide polymorphisms in selenoprotein genes and the evidence as they influence risk of colorectal, prostate, lung or breast cancers. They proposed the need to take baseline selenium status and genetic factors into account in the design of future intervention trial. Brasky et al. (2013) examined associations between plasma phospholipid fatty acids and prostate cancer risk among participants in the selenium and vitamin E cancer prevention trial. This study confirms previous reports of increased prostate cancer risk among men with high blood concentrations of polyunsaturated fatty acids. The consistency of these findings suggests that these fatty acids are involved in prostate tumorigenesis.

Results from clinical trials suggest that selenium-enriched yeast but not selenomethionine may be effective at reducing prostate cancer risk. Richie et al. (2014) compared the effects of selenium-enriched yeast and selenomethionine on prostate cancer risk and biomarkers in men. They showed the reduction of biomarkers of oxidation stress following supplementation with selenium-enriched yeast but not selenomethionine in healthy men. The influence of seleni-triglycerides on the expression of oxidative stress genes in normal and malignant prostate cells was studied by Ksiazek et al. (2013).

Based on the obtained data, malignant prostate cells exhibited a significantly lower potential for antioxidant defence when compared to normal prostate cells. Nambiar and Singh (2013) discussed the major epidemiological and clinical studies advocating androgen inhibitors, flavonoids and antioxidants in preventing prostate cancer. Flavonoids such as silibinin, green tea, polyphenols and oxidant potentials like lycopene, selenium and vitamin E have also been explored.

Glybels et al. (2013, 2014) investigated whether the association between toenail selenium levels and advanced prostate cancer risk is modified by common genetic variation in selenoprotein genes selenoprotein P and glutathione peroxidase 1. Toenail clippings were used to determine selenium levels and isolate DNA for genotyping. Toenail selenium levels were inversely associated with advanced prostate cancer risk, independently of common genetic variation in selenoprotein and glutathione peroxidase.

A systematic review of studies on prostate cancer and antioxidant intake from diet and supplements was provided by Vance et al. (2013). Tea and coffee appear to offer protection against advanced prostate cancer. Different forms of vitamin E appear to exact different effects on prostate cancer with alpha-tocopherol potentially increasing and gamma-tocopherol potentially decreasing the risk of the disease. There is no strong evidence for a beneficial effect of selenium, vitamin C, or beta-carotene, whereas lycopene appears to be negatively associated with risk of the disease.

The effect of dietary antioxidants on prostate cancer remains undefined and inconclusive with different antioxidants affecting prostate cancer risk differentially. Parnes et al. (2013) indicated that the failure of chemoprevention strategies targeting oxidative stress reduced the level of interest in the field after the negative results of selenium and vitamin E cancer prevention trial. Zhan et al. (2013) supported a potential combination therapy for improving MDV 3100 efficacy and provided a rationale for evaluating the clinical application of combining methylselenol prodrg with MDV 3100 for treatment of castration-resistant prostate cancer.

It is known that methylselenenic acid, especially methylselenocystein has potent anti-tumor activity by inhibiting cell proliferation of several cancers, prostate cancer inclusive. The study of Sinha et al. (2014) showed that methylseleninic acid promotes apoptosis in invasive prostate cancer cell in part by downregulating hypoxia inducible factor HIF-1 alpha. They extended these studies to evaluate the impact of the acid on REDD 1 in inducing cell death of invasive prostate cells in hypoxia.

Prostate cancer is a leading cause of morbidity and mortality in men and has significant treatment-associated complications. Prostate cancer chemoprevention has the potential to decrease the morbidity and mortality associated with this disease. Chemoprevention research primarily focused on nutrients and 5-alpha-reductase inhibitors (Parnes et al., 2014; Sandhu et al., 2013; Yang et
al., 2013; Thompson et al., 2014). Selenium was found to be effective in preventing prostate cancer in the nutritional prevention of cancer trial, which motivated two other clinical trials: the selenium and vitamin C cancer prevention trial and Phase III trial of selenium to prevent prostate cancer in men with high-grade prostatic intraepithelial neoplasia. However, these two trials failed to confirm the results on nutritional prevention of cancer trial and indicated that the selenium may not be preventive of prostate cancer.

CONCLUSIONS

From the data, it is evident that from human and laboratory studies different biological effects of the various inorganic and organic chemical forms of selenium were indicated, which may explain apparent inconsistencies across studies. Overall, available epidemiologic evidence suggests no cancer preventive effect of increased selenium intake in healthy individuals and possible increased risk of other diseases and disorders.

REFERENCES


