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Editorial Open Access

Significance of Synthetic SERMs in Women's Health

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Editorial

Natural disposition of breast cancer is statistically determined to be one in eight women imposing a great challenge to onco- and gynecologists to manage such a life threatening disorder. Many breast cancers are linked to the estrogen level imbalance. In addition to this, osteoporosis is another estrogen dependent medical disorder with that at least one in every three women and every five men over the age of 50 years suffer. Osteoporosis is an orthopedic onset when there are not enough new bones available to replace the feeble or broken ones. In this condition, the bones gradually become thin and fragile and more likely to get fractured. Osteoporosis is more common in women after the menopause, a condition when the level of the female hormone estrogen decreases. In essence, estrogen slows down bone breakdown and makes the bones less likely to fracture. Noticeably, known to affect more women than men, osteoporosis is a disease which has no symptoms in the beginning. An injury which would otherwise be considered inconsequential in healthy individuals, would lead to a fracture in osteoporotic patients. Fractures usually occur in the vertebral column, ribs, hip and wrists. Paradoxically, osteoporosis also affects 40% of men who are regular smokers and alcoholics.

The estrogen hormone is useful for the bone health, joint integrity, muscles and helps better calcium absorption. As women age, estrogen levels decrease and the risk of osteoporosis goes up.

In order to alienate breast cancer (early stages) it is required to have perfect control on the functioning of the estrogen. Estrogen helps cells (either normal or abnormal) to multiply which would otherwise be essential for typical performance of its hosting cellular system.

Selective Estrogen Receptor Modulators (SERMs) meant for treating the breast cancer typically antagonize the effects of estrogen in the breast tissue as it binds with the estrogen receptors in the cells. Once the receptor site is blocked with the SERM, cells do not receive the signals to grow and multiply thereby early cancer cells can be tamed from being multiplied. There are other cells from different tissues those have estrogen receptors *viz* bones and the uterus. Structurally, estrogen receptors are found to be tissue specific. Estrogen receptors from breast cell are slightly different from the one present in bone and uterine cells. This structural distinction in the estrogen receptors allowed scientists to design such molecules that can selectively bind one of the tissue specific receptors leaving behind others' molecular integrity and functions unaffected.

There are many synthetic SERMs available in the estrogen dependent anti-cancer tool box. What sets apart few of them e.g. tamoxifen, raloxifene and toremifene from others is their optimal health benefits than the side effects. In particular, tamoxifen can reduce the risk of breast cancer re-onset after treatment by 40% to 50% in postmenopausal women and by 30% to 50% in premenopausal women. It can also reduce the risk of a development of new cancer in the other breast by about 50%. Advantageously, tamoxifen lowers breast cancer risk in women who have a higher risk of disease but have not yet been diagnosed. In addition to this, tamoxifen offers other health benefits that are not related to treatment of the cancer. Since tamoxifen is classified as one of the most widely used SERMs, it selectively blocks action of the estrogen in the breast cells and activates estrogen's action in bone and liver cells. Therefore, tamoxifen is adjudged to help retard bone loss after menopause and lower the cholesterol level.

Breast cancer, osteoporosis and other estrogen dependent medical disorders appear to be one of the everlasting medical tedium which needs to be addressed quite sensibly. Although there are many medicines available in the market but it is yet to access ideal selective estrogen receptor modulator (SERM) that finds a critical balance without exerting severe side effects on the patients.

Research in medicinal chemistry, molecular and structural biology is quite advanced to unravel the multiple tissue specific interactions of estrogens and estrogen receptor that can provide a platform for the drug design more knowledge based and more rational. Subsequently, future prospects for meaningful SERM discovery can be envisioned.

Considering the relevance of SERMs for the management of osteoporosis and different types of cancer related to reproductive system, there may be uninterrupted efforts in the discovery, development and commercialization of such molecules. Advances in the areas of receptor's function, medicinal and synthetic organic chemistry i.e. asymmetric synthesis, organometallic and organocatalysis would enable scientists to succeed in the discovery and commercial access of library of such entities. In order to venture into successful drug discovery program it is imperative to establish a meaningful collaboration with able institutions/industries to facilitate the design, *in silico* analysis, synthesis, *in vitro* and *in vivo* biological evaluation to ascertain the efficacy of these molecules that can further be developed or licensed out for commercial productions.

I think it would be great if the passionate scientists from all the relevant streams (computational chemist, medicinal chemist, synthetic organic chemists, biologists, scientists from medical fraternity, policy makers and public awareness group members) come together and work in a collaborative fashion towards developing a series of SERMs that might change the currents scenario of women's health in years to come.

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