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Role of Estrogen in Males: An Update

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Mini Review

It has been 75 years since the discovery of estrogen as a hormone. These years have been marked with enormous progress in our understanding towards the working of this hormone and the functions of its receptors. Besides its indispensible role in reproduction, estrogen is involved in most physiological processes like behaviour, appetite, bone formation and wound healing. Although traditionally considered a 'female' reproductive hormone, the role of estrogens in males is now well established. Estrogen receptors have been found to localise throughout the male reproductive tract and testis being an important site of estrogen biosynthesis.

Pioneering studies done by groups of Rao et al. [1] and Robaire et al. [2] brought to fore the effects of administration of supra-physiological doses of exogenous estrogen in males. These studies reported a decrease in male fertility and a concomitant suppression of HPT axis due to feedback regulation of estrogen. Thereafter studies done by Hess and coworkers [3] and in our lab [4,5] have further investigated the effects of this hormonal disruption on the seminiferous epithelium. It was noted however that increase in estradiol levels would result in drastic reduction of testosterone and gonadotropin levels hence the effects observed would be a compound effect of all these hormonal perturbations together. At that time, most studies offered indirect evidence for the role of estrogen in spermatogenesis and male reproduction: through estrogen exposure models, presence of ERs and aromatase (the enzyme for estrogen synthesis) in the testes and ER knockout studies. There was a need to delineate the direct role of estrogen and its receptors in testicular and sperm function. Thus, our laboratory sought to selectively activate estrogen signaling through either of its receptors using agonists specific for the two estrogen receptors (ER) α and β. We have observed decreased male fertility and sperm counts without significantly affecting the HPT axis. While ERα is involved in differentiation of round spermatids into elongated spermatids; ERβ regulates germ cell apoptosis and sperm release [6,7]. These studies have indicated the putative roles of estrogen receptors in male germ cell maturation and fertility. In agreement with our in vivo agonist models, our ex vivo seminiferous tubule culture studies have further delineated genes related to sperm release that are involved in the processes of actin reorganization are regulated by estrogen via signaling through ERβ while those involved inendocytosis are androgen-regulated [8]. We have also shown that Arpc1b, an ERβ regulated protein, plays indispensible role in actin nucleation during sperm release, blood-testis barrier integrity, along with a moonlighting function in germ cell division during spermatogenesis [9].

Despite all these advances there are still gaps in our knowledge and understanding of estrogen receptors working at the fundamental genomic level and the genes they regulate in the testis. We must also bear in mind the heterogeneous population residing in the testis composing of germ cells and somatic cells like Sertoli and Leydig cells, which implies that the ERs may have different genome binding landscapes and functions in these cells. The recent discovery of a membrane bound estrogen receptor, GPER, by Carreau's group has added a further dimension to the effects of estrogen on the seminiferous epithelium [10]. The importance of understanding the functions of estrogen and its receptors in male reproduction is evident from several studies showing exposure to various endocrine disruptors to be the one causes of declining sperm quality and counts in men over the past 50 years [11]. Many endocrine disruptors found in the environment like organic pesticides DTT and methoxychlor, plasticizers like Bisphenol A, are estrogenic in nature and are reported to cause adverse effects not only on male fertility but also on the reproductive function of the subsequent generations [12].

With technical advancements such as cell type-specific conditional knockdown/knockout, gene editing and high

throughput discovery methods like NGS, we are close to understanding direct molecular targets of estrogen and their regulation in a cell-specific context. Such studies are the need of the hour and will bring forth earlier unexplored areas of estrogen function in male reproduction.

References

1. Rao MV, Chinoy NJ (1983) Effect of estradiol benzoate on reproductive organs and fertility in the male rat. Eur J Obstet Gynecol Reprod Biol 15(3): 189-198.
2. Robaire B, Duron J, Hales BF (1987) Effect of estradiol-filled polydimethyl siloxane subdermal implants in adult male rats on the reproductive system https, fertility, and progeny outcome. Biol Reprod 37(2): 327-334.
3. Hess R, Bunick D, Bahr J (2001) Oestrogen, its receptors and function in the male reproductive tract - a review. Mol Cell Endocrinol 178(1-2): 29-38.
4. Gill-Sharma MK, Dsouza S, Padwal V, Balasinor N, Aleem M, et al. (2001) Antifertility effects of estradiol in adult male rats. J Endocrinol Invest 24(8): 598-607.
5. D'Souza R, Gill-Sharma MK, Pathak S, Kedia N, Kumar R, et al. (2005) Effect of high intratesticular estrogen on the seminiferous epithelium in adult male rats. Mol Cell Endocrinol 241(1-2): 41-48.
6. Dumasia K, Kumar A, Kadam L, Balasinor N (2015) Effect of estrogen receptor subtype-specific ligands on fertility in adult male rats. J Endocrinol 225(3): 169-180.
7. Dumasia K, Kumar A, Deshpande S, Sonawane S, Balasinor NH (2016) Differential roles of estrogen receptors, ESR1 and ESR2, in adult rat spermatogenesis. Mol Cell Endocrinol 428: 89-100.
8. Kumar A, Dumasia K, Gaonkar R, Sonawane S , Kadam L, et al. (2015) Estrogen and androgen regulate actin-remodeling and endocytosis-related genes during rat spermiation. Mol Cell Endocrinol 404: 91-101.
9. Kumar A, Dumasia K, Deshpande S, Gaonkar R, Balasinor NH (2016) Actin related protein complex subunit 1b controls sperm release, barrier integrity and cell division during adult rat spermatogenesis. Biochim Biophys Acta 1863(8):1996-2005.
10. Chimento A, Sirianni R, Casaburi I, Pezzi V (2014) Role of estrogen receptors and g protein-coupled estrogen receptor in regulation of hypothalamus-pituitary-testis axis and spermatogenesis. Front Endocrinol 5: 1.
11. Sharpe R, Skakkebaek N (1993) Are oestrogens involved in falling sperm counts and disorders of the male reproductive tract? Lancet 341(8857): 1392-1395.
12. Toppari J, Larsen JC, Christiansen P, Giwercman A, Grandjean P, et al. (1996) Male reproductive health and environmental xenoestrogens. Environ Health Perspect 104(Suppl4): 741-803.

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