Fertility preservation in cancer patients

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Advances in cancer therapy have improved the long-term survival of young cancer patients. Fertility preservation has become an emergent need and the matter of concern for any case where the reproductive function is threatened. Oncofertility has emerged as an interdisciplinary field bridging biomedical, social sciences and examines issues regarding an individual's fertility options, choice and goals in light of cancer diagnosis, treatment and survivorship. The effects of radiation and chemotherapy on gonadal function are relevant to the morbidity induced by such treatments. Alkylating agents are the most reliably gonadaltoxics of chemotherapeutic agents in common clinical use currently. Much effort and attention has been paid to preserving fertility in women with cancer, who can lose their ovarian function after chemo- or radiotherapy. Fertility preservation is of utmost importance for both men and women and is not solely a "woman's issue". The testis is more sensitive than the ovary to cytotoxic therapy, so the ensuing injury is more damaging to male fertility than it is to female fertility.

Experimental and clinical strategies for preserving fertility include surgical ovarian translocation (oophoropexy) to avoid radiation, radical trachelectomy for cervical cancer, medical less gonadotoxic chemotherapy for the reproductive age, GnRHa to reduce gonadal damage from chemotherapy, targeted antiapoptotic agents for germ cell protection, cryopreservation of spermatozoa, oocytes, embryo, gonadal tissue or intact gonads and tissue engineering of artificial ovary. Suppression of the hypothalamic–pituitary–ovarian axis by a GnRH analogue has been proposed to be a noninvasive method to protect the ovarian reserve from chemotherapy. Protective effect of a gonadotropin-releasing hormone analogue on chemotherapeutic agent-induced ovarian gonadotoxicity in animal model lends weight to the effective application. In humans, the effect of GnRH analogues in parallel to chemotherapy has been examined. Despite the promising effects of

GnRH analogues, the unequal follow-up time, different treatment protocols, poorly defined endpoints, less sensitive markers (such as pregnancy rate, resumption of menstruation, levels of serum sex steroids and gonadotropins) and limitation of sample size, all affect the strength of the conclusion.

Since the middle of the 20th century, cryopreservation of living cells, tissues, and organs has been applied across abroad range of medical applications for use with endangered or economically beneficial species. With the advent of mature assisted reproductive technology over the past two decades, cryopreservation of embryo and gamete becomes the most accessible strategy but the drawback of limited egg and embryo number for each practice remains. With the significant increase in studies on cryopreservation of ovarian tissue conducted since the 1990s, subsequent transplantation after completed cancer treatment has been suggested as an alternative to restore fertility for girls and women who are at high risk for ovarian failure after chemotherapy or radiotherapy. Until the end of 2010, a total of 14 live births have been reported by slow freezing of ovarian tissue preservation. The whole ovarian cryopreservation and vitrification of ovarian tissue followed by transplantation have been paid much effort and attention but still in infancy with limited clinical achievement.

Cryopreservation of mature spermatozoa for men or postpubertal boys with cancer is available before chemo- and radiotherapy. Experimental techniques are also under development for preserving the fertility of prepubertal boys by germ cell transplantation, testicular xenografting, autografting, or by the cryopreservation of immature testicular tissue. The intensive work of male fertility preservation for spermatogonial stem cell and testicular tissue in small animal model, non-human primates and humans raises the future application in prepubertal boys although not yet live birth in human nowadays.

In light of rapid advances in fertility preservation, the increasing successes of oncologic treatments make implementation of procedures aimed at preserving fertility for cancer patients even more crucial.