Biomedical & Pharmacology Journal, March 2022. Vol. **15**(1), p. 1-4

Chemosterilization in Male: 'Past And Present' in Reproductive Biology

Pallav Sengupta[1,3]* and Sulagna Dutta[2,3]

[1]Physiology Unit, Faculty of Medicine, Bioscience and Nursing, MAHSA University, Malaysia.
[2]School of Medical Sciences, Bharath Institute of Higher Education and Research (BIHER), India.
[3]Department of Oral Biology and Biomedical Sciences, Faculty of Dentistry, MAHSA University, Malaysia.
*Corresponding Author E-mail: pallav_cu@yahoo.com

https://dx.doi.org/10.13005/bpj/2336

(Received: 07 January 2022; accepted: 25 February 2022)

Biology Research

The effects of chemosterilizing agents on the testes and sperm production and maturation are much less understood than their effects on the ovaries and oogenesis. It was discovered that sterilising male insects with ionising radiation caused the emergence of chromosome-wide or chromatid-specific dominant lethal mutations, which led to the development of the classical male castration techniques[1, 2]. It was discovered in those investigations that alterations were not frequently found on spermatozoa, but that they were commonly visible in anomalies during the division of the zygote in the fertilised egg[2, 3]. Dominant lethal mutation in the screw-worm, *Cochliomyia hominivorax*, were first discussed vividly by LaChance & Riemann (1964)[3] and LaChance & Crystal (1965)[4], in the most classic experiments ever conducted. Detailed information on and complications related to dominant lethal mutations in insects caused by irradiation and sterilizing agents have been enumerated by LaChance (1967), who has also incorporated a detailed references containing research that dispensed this arena long before the era when chemosterilizing agents were introduced into the scientific community[5].

Chemical castration is no longer considered to be a real castration because it is no more invasive these days. When the treatment is stopped, it is generally considered to be reversible, but not always. It has been discovered in a number of recent experiments that chemosterilization has the ability to reduce testosterone levels in the bloodstream[6, 7]. Endogenous androgens are important regulators of male sexuality[7, 8]. Testosterone levels have an effect on both erections and ejaculations[9, 10]. A testosterone surge, on the other hand, occurs as a result of sexual activity[11, 12]. As a result, androgen receptor antagonists such as steroid antiandrogens and GnRH-agonists diminish sex drive by hindering androgen receptor binding[13].

As a result, both classical and recent experiments have demonstrated that chemosterilizing agents have an effect on the testicles and spermatogenesis[14, 15]. In present times, there lacks reasonable relevance of strong

mutagens, such as those used in conventional insect research, and recent research has looked into the possibility of using chemicals to cause aspermia or inactivate sperm for the purpose of sterilisation. The mechanism of action of these chemicals investigated thus far showed that spermatogonia and developing spermatocytes that are undergoing division are the most affected cells[16, 17]. As a result of the degeneration of spermatogenic cells, the size of the testicles as a whole decrease[18]. It is because they are androgen dependant that the accessory glands degenerate and the sperm transport during copulation is prevented[19]. The results of recent animal experiments lend further support to this theory[20]. Recent studies have also demonstrated that some chemosterilizing agents are capable of inducing oxidative stress (*i.e.,* generating reactive oxygen species) in the environment[6, 21]. Several other studies have reported that certain chemicals have steroidogenesis inhibitory activities[18]. Previous investigations on the induction of dominant lethal mutations have also stated that the impacts of chemosterilizing agents on sperm production and maturation are frequently followed by a decrease in the vitality of sperm, which may result in its immobility or even death[4, 5]. The degree of spermatozoa motility in spermathecae of *Musca domestica* (common housefly) females that had been sterilized with Brestan and Tinicide was investigated in another classic experiment conducted by Ascher *et al.* (1968). In their research, they discovered that the extent of fertility is directly proportional to the degree of sperm motility[20].

So far, different chemosterilizing agents have been tested and found to be effective, but two of the most effective are medroxyprogesterone acetate (MPA) and cyproterone acetate (CA). It is also popular by the brand names Clinovir, Cycrin, Depo-Provera, and Hystron. MPA is a hormonal castration agent used for the treatment of male infertility. MPA was first introduced to the market in order to treat female gynaecological issues. It has also been known for worsening drug therapy and the risk for the induction of non-alcoholic fatty liver disease (NAFLD)[22, 23]. Medicinal marijuana (MPA) was removed from the market by the Food and Drug Administration (FDA) in 1978. MPA is available as a birth control pill in countries other than the United States; however, the FDA has never approved it for this purpose. For the first time, Heller *et al.* (1958) discovered that progestational compounds reduced testicular volume and completely suppressed male libido in males[24]. MPA suppresses testosterone production by inhibiting gonadotropin secretion, which in turn suppresses testosterone production. MPA has been shown to accelerate testosterone metabolism in the liver, resulting in lower testosterone levels in the blood[25]. MPA is administered as a 400 mg intramuscular injection once a week, administered intravenously[24, 25]. The effects of MPA are noticeable within 2-3 weeks of beginning of the treatment. Gagne (1981) conducted a historical study with 48 respondents, finding that forty participants responded positively to MPA and that all participants experienced decreased sexual fantasy, arousal, and urges as a result (particularly masturbation). MPA has been shown to significantly reduce the number of ejaculations and testosterone levels in the bloodstream[26]. As an alternative, cyproterone acetate (CPA), which is marketed under the brand names Androcur, Cyprone, Cyprostat, and Dianette, is not formally permitted in the United States, but is approved in Canada, the United Kingdom, and Germany for use in the treatment of acne. Because MPA and CPA are not available in the same countries, it is difficult to conduct comparative studies between the two drugs. Laschet and Laschet (1971) conducted a study on the clinical uses of CPA in which they administered CPA at 100mg oral doses daily or 300mg intramuscularly every two weeks to 100 sexually deviant male participants significantly reduced or eliminated sexual drive, erections, and orgasms. Competitive inhibition of testosterone and DHT at androgen receptors is the mechanism by which CPA reduces testosterone production. CPA, like MPA, has a suppressive effect on sexual fantasies, libido, the number of ejaculations, and spermatogenesis in the male reproductive system[27].

There is little information available about the behavioural consequences of chemocastration. However, only a few studies have been conducted in this area. Vinke *et al.* (2008) have reported the effects of surgical and chemocastration on inter-male aggression, sexual behaviour, and play behaviour in male ferrets (European polecats) were assessed and compared in order to determine which was more effective. Animals that had undergone chemical castration showed less aggression toward

other males, regardless of whether or not they were in the presence of a receptive female. Chemical castration, as opposed to surgical castration, had a greater impact on the reduction of aggression[28]. In 2001, researchers conducted a study to establish the impacts of deslorelin administration on regulation of reproduction and sexual behaviour in wild animals. The results were published in the journal Biological Control. However, despite the fact that this study was brief and only with a small number of animals, the subsequent primary annotations were recorded: After being treated with a deslorelin implant, male sea otter antagonistic behaviour was no longer observed, and no adverse effects on social behaviour were observed in four male cheetahs who were also treated with deslorelin[29].

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