Human Reproductive Biology : Changes Through Life

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Abstract

Human sexuality is the capacity of human beings to have erotic experiences and responses. Genetics and endocrine system is known to majorly impact human reproductive system and sexuality over the entire lifespan. Ovaries, the most important organ in females gradually grow unresponsive to gonadotropins with advancing age, and their function declines, so that menopause occurs. Although the function of the testes too tends to decline slowly with advancing age, it is still unclear whether there is a 'male menopause' (andropause) similar to that occurring in women.

Introduction

A person's sexual orientation can influence their sexual interest and attraction for another person [1]. Sexuality may be experienced and expressed in a variety of ways, including thoughts, fantasies, desires, beliefs, attitudes, values, behaviors, practices, roles, and relationships [2].

These may manifest themselves through biological, physical, emotional, social, or spiritual aspects. The biological and physical aspects of sexuality largely concern the human reproductive functions, including the human sexual response cycle and the basic biological drive that exists in all species [3]. Physical and emotional aspects of sexuality include bonds between individuals which gets expressed through profound feelings or physical manifestations of love, trust, and care. While, the social aspects encompasses the effects of human society on one's sexuality, the spiritual aspects is concerned with an individual's spiritual connection with other members of the society. Sexuality impacts and is impacted upon by cultural, political, legal, philosophical, moral, ethical, and religious aspects of life.

Reproductive biology

Modern genetics and embryology make it clear that, in most species of mammals, the multiple differences between the male and the female are primarily due to a single chromosome i.e. the Y chromosome and a single pair of endocrine structures, the testes in the male and the ovaries in the female. The differentiation of the primitive gonads into testes or ovaries in utero is genetically determined in humans, but the formation of male genitalia depends on the presence of a functional, secreting testis; and, in the absence of testicular tissue, the development is female. After birth, the gonads remain quiescent until adolescence, when they are activated by gonadotropins from the anterior pituitary. Hormones secreted by the gonads at this time cause the appearance of features, typical of the adult male or female. In human females, ovarian function regresses after a number of years and menstrual cycles come to a halt. In males, gonadal function slowly declines with advancing age, but the ability to produce viable gametes persists. In both sexes, the gonads have a dual function: the production of germ cells and the secretion of sex hormones. Particularly, during pregnancy, the ovaries secrete the polypeptide hormone relaxin, which loosens the ligaments of the pubic symphysis and softens the cervix, facilitating delivery of the fetus. In both sexes, the gonads secrete other polypeptides, including inhibin B, a polypeptide that inhibits follicle-stimulating hormone (FSH) secretion. The secretory and gametogenic functions of the gonads are both dependent on the secretion of the anterior pituitary gonadotropins, FSH and luteinizing hormone (LH). In males, gonadotropin secretion is noncyclic; but in postpubertal females, an orderly, sequential secretion of gonadotropins is necessary for the occurrence of menstruation, pregnancy and lactation.

Reproductive physical maturity and the capacity for human reproduction begin during puberty. A period of rapid growth and change experienced by both males and females, puberty is not an isolated event, but a process which takes place over several years.

During puberty, the hypothalamus, a gland located at the base of the brain produces hormones. These hormones stimulate the reproductive glands, which produce testosterone in males and estrogen and progesterone in females. Male puberty, generally, occurs between the age of 13 and 15 years. It is characterized by the secretion of the male hormone testosterone, which, in turn, stimulates spermatogenesis (sperm production), and the development of secondary sexual characteristics (increased height and weight, broadening shoulders, growth of the

testes and penis, pubic and facial hair growth, voice deepening, and muscle development).

Female puberty generally occurs during the age from 9 to 13 years, and results in ovulation and menstruation, in response to cyclic hormonal changes in estrogen and progesterone. Secondary sexual characteristics (growth of pubic and underarm hair, breast enlargement, vaginal and uterine growth, widening hips, increased height, weight and fat distribution) also occur as part of the female pubertal process.

Aging changes in the male reproductive system

Aging changes in the male reproductive system may include changes in testicular tissue, sperm production, and erectile function. These changes usually occur gradually. Unlike women, men do not experience a major, rapid change in fertility as they age. Instead, changes occur gradually during a process that some people call as andropause.

Aging-related changes in the male reproductive system occur primarily in the testes. As age advances, testicular tissue mass decreases. The level of the male sex hormone, testosterone stays the same or decreases gradually. There may be problems in getting an erection. This is a general slowing down of the process, rather than a complete lack of function.

The tubes that carry sperm may become less elastic. The testes continue to produce sperm, but the rate of sperm cell production slows down. Likewise, epididymis, seminal vesicles, and prostate gland also lose some of their surface cells. But they continue to produce the fluid that helps carry sperm. With age, the prostate gland enlarges. This condition, known as benign prostatic hypertrophy (BPH), affects about 50% of men. BPH may cause urination and ejaculation problems.

Effect of changes

Fertility varies from man to man. Age does not predict male fertility. Prostate function does not affect fertility. Potentially, a man can become father of a child, even if his prostate gland has been removed. Some fairly old men can (and do) procreate children. The volume of fluid ejaculated usually remains the same, but there are fewer living sperm in the fluid as age advances. Some men may have a lower sex drive. With age, sexual responses may become slower and less intense. This may be attributed to decreased testosterone level. It may also result from psychological or social changes associated to aging such as lack of a willing partner, illness, chronic conditions, or medications. Aging, by itself, does not deprive a man from enjoying sexual relationships.

Puberty in male

When a baby boy is born, he has all the parts of his reproductive system in place, but it isn't until puberty that his reproductive organs mature and become fully functional. In a newborn, FSH and LH levels are high, but after a few weeks these levels drop to extremely low. As puberty sets in, usually between the ages of 10 and 14, the pituitary gland starts secreting hormones that stimulate the testicles to produce testosterone. The production of testosterone brings about many physical changes. Although the timing of these changes varies with each individual male, the stages of puberty generally follow a set sequence [4].

In the first stage, the scrotum and testes grow larger, and the apocrine glands develop. In the second stage, the penis becomes longer,

and the seminal vesicles and prostate gland grow. Hair begins to appear in the pubic region. Usually, reproductive capacity is known to have developed by this stage.

The third stage is marked by the appearance of hair on the face and the underarms. During this stage, a male's voice also deepens.

Growth of genitalia

A boy's penis grows little from the fourth year of life until puberty. On an average a prepubertal penis measures 4 cm in length. Within months after growth of the testes begins, rising levels of testosterone promote growth of the penis and the scrotum. The penis continues to grow until about 18 years of age, reaching an average adult size of about 10-16 cm [4].

Although erections and orgasms can occur in prepubertal boys, they become much more common during puberty, accompanied by development of libido. Ejaculation becomes possible early in puberty; and prior to that boys may experience dry orgasms. Emission of seminal fluid may occur due to masturbation or spontaneously during sleep (commonly termed as wet dream and clinically called as nocturnal emission). The ability to ejaculate occurs in boys fairly early in puberty compared to other characteristics, and may precede reproductive capacity itself. In parallel to the irregularity of the first few periods of a girl, for the first one or two years post his first ejaculation, a boy's seminal fluid may contain few active sperm. If the foreskin of a boy does not become retractable during childhood, it normally begins to retract during puberty. This occurs as a result of the increased production of testosterone and other hormones in the body [4].

Common problems

Erectile Dysfunction (ED) may become a concern for aging men. It is normal for erections to occur less often in aging men than when they were younger. Aging men are often less able to have repeated ejaculations. 90% of ED is believed to be caused by a medical problem instead of a psychological problem.

Medicines (especially those used to treat hypertension and certain other conditions) can prevent a man from getting or keeping enough of an erection for intercourse. Disorders, such as diabetes, can also cause ED. Erectile Dysfunction that is caused by medicines or illness is often successfully treated [5,6].

BPH may eventually interfere with urination. Changes in the prostate gland make elderly men more likely to have urinary tract infections. Prostate gland infections or inflammation (prostatitis) may also occur. Prostate cancer, one of the most common causes of cancer death in men, becomes more likely as men age. Testicular cancers are possible, but these occur more often in younger men also [5,6].

Prevention

Many age-related physical changes, such as prostate enlargement or testicular atrophy, are not preventable. Getting treated for health disorders, such as high blood pressure and diabetes, may prevent problems with urinary and sexual function. Changes in sexual response are most often related to factors other than simple aging. Older men are more likely to have good sex if they continue to be sexually active during middle age.

Aging changes in the female reproductive system

As a woman ages, a number of changes take place in her reproductive system. Aging changes in the female reproductive system result mainly from changing hormone levels. A clear sign of aging manifests itself when a woman's menstrual periods stop permanently. A normal part of a woman's aging process, the phenomenon is known as menopause. As the ovaries stop releasing eggs (ova), the menstrual periods stop. Menopause occurs in most women around the age of 50 years. However, it occurs before the age of 40 years in about 8% of women. Prior to menopause, menstrual cycles often become irregular.

For women, the cessation of menses (menopause) is an obvious sign of aging. But, it is by no means the only change. A transition period, called the climacteric, lasts for many years before and after a woman's last menstrual period. For a woman, aging changes involve hormone levels, physical changes in the woman's entire reproductive tract, and psychological changes. Changes occur in the intricate relationship between the ovarian hormones and hormones produced by the pituitary gland [7,8].

The time around menopause is called perimenopause. It may begin several years before last menstrual period. Signs of perimenopause include more frequent periods at first, and then occasional missed periods; periods that are longer or shorter; and changes in the amount of menstrual flow.

Eventually periods will become much less frequent, until they stop completely. Along with the changes in periods, physical changes in woman's reproductive tract occur as well.

Puberty in female

During the period from birth to puberty, a neural mechanism operates to prevent the normal pulsatile release of GnRH. The age at the time of puberty is variable. In girls, the first event is thelarche, the development of breasts, followed by pubarche, the development of axillary and pubic hair, and then by menarche, the first menstrual period. Initial menstrual periods are generally anovulatory, and regular ovulation appears about a year later.

It has been argued for some time that a critical body weight must normally be reached for puberty to occur. Thus, for example, young women who engage in strenuous athletics lose weight and stop menstruating, as do girls with anorexia nervosa. If these girls start to eat and gain weight, they menstruate again, that is, they 'go back through puberty.' It now appears that leptin, the satiety-producing hormone secreted by fat cells, may be the link between body weight and puberty. However, the way that leptin fits into the overall control of puberty remains to be determined.

Effects of changes

With menopause, ovaries in women stop producing the hormones estrogen and progesterone.The ovaries also stop releasing eggs. The ovaries become less responsive to stimulation by follicle-stimulating hormone (FSH) and luteinizing hormone (LH).

Prior to menopause, fertility varies depending on hormone levels. Menopause is said to have occurred when there has been one year without a menstrual period. With menopause, reproductive capacity is lost. Any bleeding that occurs more than 1 year after the last period is not normal and should be checked.

As hormone levels fall, other changes tend to occur in the reproductive system. Vaginal walls become thinner, dryer, and less elastic, and possibly irritated. Sometimes sex becomes painful due to these vaginal changes. Risk of vaginal yeast infections increases.

Amongst other common changes, a woman may experience menopausal symptoms such as hot flashes, moodiness, headaches, and trouble sleeping. She may also have problems with short-term memory. This phase is also marked by decrease in breast tissue; lower sex drive and sexual response; increased risk of bone loss (osteoporosis); and loss of tone in the pubic muscles. Changes related to the urinary system, such as frequency and urgency of urination and an increased risk of urinary tract infection too may be witnessed.

Common problems

The pubic muscles lose tone, and the vagina, uterus, or the urinary bladder can fall out of position. This is called vaginal prolapse, bladder prolapse, or uterine prolapse, depending on the structure that drops.

Irritation of the external genitals may also occur (pruritus vulvae). The vaginal walls grow thinner and dryer and may become irritated (atrophic vaginitis). Sexual intercourse may become uncomfortable for some women (dyspareunia). There are changes in the levels of normal microorganisms in the vagina, and there is an increased risk of vaginal yeast infections. Similar changes to the bladder and urethra may increase symptoms such as frequency and urgency of urination, and there is an increased risk of urinary tract infection after menopause, as discussed earlier.

Hot flashes, mood disturbances, headaches, and sleep disturbances are also common symptoms that occur during menopause. The causes of these changes are not well understood, but they are also related to the decreasing amount of estrogen produced by the ovaries. Risk of Osteoporosis is greater in older women. This is caused, in part, by decreased estrogen levels [9].

Prevention and treatment

Adequate lubrication can help prevent painful sexual intercourse. Vaginal moisturizers are available without prescription. Applying topical estrogen inside the vagina may help in thickening the vaginal tissue and increasing moisture and sensitivity inside it. Getting regular exercise, eating healthy foods, and staying involved in activities with friends and loved ones can help the aging process go more smoothly. Hormone therapy with estrogen or progesterone alone or in combination, may help menopause symptoms such as hot flashes or vaginal dryness and pain with intercourse.

However, hormone therapy (HT) may have side effects such as vaginal bleeding, and it has been associated with an increased risk of breast cancer, stroke, and heart disease. The risk and benefit of treatment is different for each person. So women should discuss the pros and cons of estrogen treatment with their personal health care providers [9].

Conclusion

Change is inevitable in human life. Sexual responses and sexual activities change as we age. It is always wise to understand the bodily changes and act accordingly.

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