Relevant Sexual Anatomy, Physiology and Endocrinology

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Gabrijela Simetinger

2.1 Introduction

To understand the physiology of sexual response, it is essential to have some basic knowledge of the genitals and other body parts associated with human sexual response. Since midwives and obstetric HCPs will be familiar with most of the anatomy and physiology of this area, this chapter will mainly focus on the aspects relevant to sexuality. Addressing the physiology and anatomy of 'the female sexual machinery' in detail is extra appropriate because of the many similarities between sexuality and reproduction. Sexual arousal resembles, in many ways, the circulatory changes of pregnancy. For example, childbirth, orgasm and breastfeeding have much in common, including hormonal control and being able 'to let go'.

The chapter will look at the various elements of anatomy and its changes over the different stages of pregnancy, including the relevant aspects and changes in physiology and endocrinology.

A great deal of the knowledge in this chapter is extracted from the books by Masters and Johnson and Bancroft. So no additional references to that information are given [1–3].

2.2 Female Anatomy

Female genitalia can be subdivided into the internal genitalia (vagina, cervix, uterus, fallopian tubes and the ovaries) and the external genitalia (vulva), including mons pubis, clitoris, the labia majora and minora which are the structures surrounding the urogenital cleft [4].

G. Simetinger (✉)
Department of Gynaecology and Obstetrics, General Hospital Novo mesto, Novo mesto, Slovenia
e-mail: gabrijela.simetinger@sb-nm.si

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Mons pubis is the hair-covered area over the pubic bone which forms the anterosuperior limit of the urogenital cleft and ends posteriorly at the anterior margin of the perineal body. Labia majora, called the outer lips, are the two prominent, fatty lateral boundaries of the urogenital cleft. Anteriorly they meet, creating the anterior commissure in front of the glans of the clitoris, posteriorly forming the posterior commissure. On the lateral surface, the outer lips have pigmented hairy, slightly wrinkled skin, and on the vaginal side, a smooth surface lined with multiple sebaceous glands. The outer labia often meet and close the vaginal introitus. Labia minora, here called the inner lips, can be smaller (or bigger) and may vary in size (length 61 ± 17 mm, width 22 ± 9 mm, range 7–50 mm). Anteriorly, they split into two layers forming the clitoral prepuce and the clitoral frenulum. They have no subcutaneous fat or hairs, contain elastic skin and erectile tissue with an appearance between smooth and extensively corrugated.

The gross clitoral structure is like an iceberg. A tiny part—the glans—is visible while the rest is hidden beneath the skin and deep. It is a three-dimensional complex of erectile and spongious tissues [5]. The best known is the midline shaft with glans (5–10 mm long) and clitoral body (10–60 mm long). It divides into two crura (25–70 mm long), bending sideways and laying close to the ischiopubic rami. From the clitoral shaft, the clitoral bulbs, also called vestibular bulbs (15–70 mm), bend on both sides around the vulvar entrance, under the outer lips.

The clitoral body and crura contain cavernous tissue (as in the male corpus cavernosum). The clitoral body can erect and bring the clitoris more in view when fully aroused. Just as in the male corpus spongiosum, the vestibular bulbs and the glans contain spongious tissue. The swollen bulbs softly narrow the vulvar entrance. A suspensory ligament connects the clitoral body to the symphysis.

Bilaterally, the ischiocavernosus muscles originate from the ischiopubic rami and insert onto the clitoral crura.

Although the clitoral hood or prepuce (comparable to the male foreskin) can be retracted, it usually covers the glans, preventing pain. Directly touching the very densely innervated glans tends to cause too much sensation.

The ‘periurethral glans’ is the triangular part of the vaginal vestibule that surrounds the urinary meatus, extending from below the clitoral glans to the vaginal introitus and laterally to the beginning of the inner lips. The vulvar vestibule includes the vulvar area between the inferior part of the clitoris, the medial aspect of the inner lips and the fourchette (the fold posteriorly connecting the inner lips) [4].

The hymen forms the boundary between the vulva and vagina. This usually thin (but sometimes thick) layer of tissue has mostly a crescent shape in young girls, but it can have many different forms. At puberty, the circumferential elasticity increases [6]. The hymen is the subject of much confusion and fear. It can be difficult to ascertain if penetration has taken place in children. From puberty, it is even for an experienced physician very difficult ‘to prove virginity’. The first sexual intercourse/penetration is called defloration. That is usually not accompanied by blood loss, but it sometimes does, depending on the variety in anatomy. In the well-lubricated

vulva, defloration is usually also not accompanied by pain (but sometimes it does). Most defloration pain results from a combination of fear and lack of lubrication.

The vagina is a tube collapsed in the non-aroused state, with an H-shaped cross-section. It is usually 10–11 cm in length to the depth of the posterior fornix. The deeper parts are more sensitive than the superficial parts [7], and the anterior wall is more sensitive than the posterior wall.

The pelvic floor is neither flat nor horizontal. It is called the levator ani muscle and consists of several distinct muscle groups, of which the iliococcygeus and pubococcygeus are the most important ones. In the resting state, they both support the vagina and rectum, and together with the presacral fascia, they form the levator plate.

The female genitals have a rich arterial blood supply. The internal pudendal artery and the superficial branch of the femoral artery supply the labia/lips. The clitoris receives its blood supply from the terminal part of the internal iliac artery, the common clitoral artery, which branches into the clitoral cavernosal and dorsal clitoral arteries. The uterine and hypogastric arteries supply the inner part of the vagina, and the clitoral and middle haemorrhoidal arteries the outer part [2, 4].

2.3 Male Anatomy

A rigid fibrous cylinder, the tunica albuginea, encapsulates a fused pair of corpora cavernosa. These sponge-like vascular spaces of erectile tissue form the shaft or body of the penis. See Fig. 2.1.

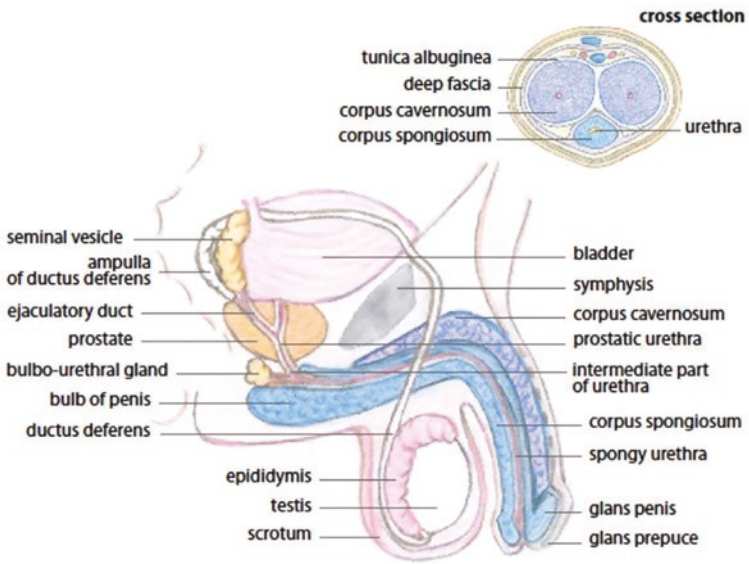

Fig. 2.1 The male anatomy. (Illustration composed by Gabrijela Simetinger and Helena Černej)

That cylinder combines an inner space that can fill up with blood (like an inner tube) and a robust outside enclosure (like a tyre), making the critical structure for a rigid, fully erect penis. The root of the penis is attached to a muscular layer, the bulbospongiosus and ischiocavernosus muscles. They contract voluntarily and semi-voluntarily during the development of erection and also rhythmically during orgasm. Beneath the two fused corpora cavernosa lies the corpus spongiosum, which envelops the urethra in its course along the lower surface of the penis. Near the tip of the penis, the corpus spongiosum expands into the glans.

In the uncircumcised male, a hood of lax skin, the prepuce or foreskin, covers the glans. A longitudinal fold of skin, the frenulum, attaches the prepuce to the glands on the lower surface. Beyond the dilated urethral bulb and before its junction with the urinary bladder, the male urethra transverses the prostate gland, a firm fibromuscular structure with glands contributing accessory fluid to the ejaculate. The penis receives its blood supply from the internal pudendal artery, one of the terminal branches of the internal iliac artery.

The testicles/male gonads lie in the scrotum, a superficial pouch of skin and muscle. Within the scrotum, the position of the testicles is controlled by the cremaster and dartos muscles, responsible for keeping the testis at a lower body temperature by actively changing their distance to the body. A long, convoluted tubule, the epididymis, bends over the testis and ends in the ductus deferens leading to the prostate gland. The final maturation of the sperm cells takes place in the epididymis. Behind the bladder and the prostate gland lie the seminal vesicles, elongated sacs that secrete accessory fluid needed for sperm viability.

2.4 The Nerve Supply to the Genitalia in Men and Women

The genitalia and pelvic floor muscles are regulated by the sympathetic and parasympathetic nervous system (pelvic nerves, hypogastric nerve, paravertebral sympathetic chains) and by the (somatic) pudendal nerve. These nerves convey impulses from the brain and spinal cord to control motor, secretory and vascular functions or mediate pleasurable or painful sensations. The autonomic nerves regulate blood flow and the involuntary smooth-muscle contractions that may accompany arousal, while the somatic nerves control the voluntary or striated muscle responses that often occur during orgasm. Sensory input from the genitalia or brain can facilitate arousal and orgasmic responses. Both somatic and autonomic systems mediate these processes. The pelvic and pudendal nerves convey the afferent (sensory) and efferent (motor) information during the urogenital reflexes. The pudendal (somatic) nerve conveys sensory stimuli from the perineum, penis, clitoris, urethra and pelvic floor musculature. The dorsal nerve of the clitoris is tiny and the most distal branch of the pudendal nerve. It terminates in a plexus of nerve endings within the substance of the glans and the corpora cavernosa.

2.5 Endocrinology of Sexual Response

Pre-pubertal boys and girls differ in their behaviour. Culture and education can explain that, but only for a minor part. Hormones form the more significant part of the explanation. However, before puberty, neither boys nor girls have gonadal hormones. The explanation lies at a much earlier moment, during intra-uterine life. The default is the development of a female baby. At ±8 weeks of pregnancy, an XY chromosome pattern encourages the cells that have to become the testes producing testosterone (T). That T is responsible for the male anatomy and different connections in the brain [1]. This neural development during intra-uterine life, called 'the dimorphic wiring of the brains', is responsible for many female-male differences in behaviour.

Despite much research, we still do not fully understand the influence of the various hormones, neuropeptides and neurotransmitters on sexual activity. The information is more evident in male sexuality than in female sexuality. And more evident in the non-pregnant woman than during pregnancy.

Testosterone ('T') appears to be the most important hormone for sexual activity, directly influencing desire and indirectly via mood and energy. Higher T-levels increase arousability, sexual fantasies and sexual activity. Sexual activity (f.i. intercourse) also increases the T-levels in men and women. In women who are not using hormonal contraception, sexual thoughts also increase their T-levels [8].

Oxytocin, well-known in obstetrics, has a relevant role in sexuality, with the levels increasing during sexual arousal and at orgasm.

Prolactin, a peptide hormone with an important role in lactation, also appears to have a role in sexuality. After orgasm, there is a rise in prolactin level, reducing sexual desire. The same happens during the high prolactin levels in the lactating woman. That 'sexual inhibition' of prolactin is supposed to act via inhibition of dopaminergic activity.

Men and women differ very much in hormonal fluctuations over time. Both have a diurnal fluctuation with the highest level of gonadal hormones in the morning. Otherwise, the male hormone levels are very predictable/stable (or dull), which is one reason why most medical research is done on men.

On the other hand, women experience significant changes in gonadal hormone levels between puberty and menopause every month, eventually interspersed by extensive periods of pregnancy and breastfeeding and contraceptive use, all influencing body and mind. That makes women far more complex (or exciting) and less predictable, with more significant risks of depression and less reliability for research.

2.5.1 Women

Testosterone Compared to male sexuality, the influence of T on female sexuality is less clear. One explanation is that women appear far more influenced by context and co-existing psychological and affective factors and partly by the wide individual variation in sensitivity to testosterone. In women, higher T-levels are linked to more

solitary desire and higher masturbation frequency and less dyadic desire (but that is only when controlled for cortisol and perceived social stress). Besides, testosterone has a relevant influence on mood, energy and arousability.

Estradiol is essential for vaginal health. Whereas the levels are very high during pregnancy, they decrease sharply after the birth, especially when the woman is breastfeeding. The resulting vaginal atrophy is comparable to the vaginal atrophy of many women during menopause. It is tempting to explain that atrophy responsible for dyspareunia (pain at intercourse). However, dyspareunia usually results from insufficient lubrication, caused by lower arousability, poor couple communication and poor sexual stimulation.

Oxytocin, one of the peptides, has multiple reproductive roles. During lactation, it facilitates the milk ejection reflex. During parturition, it stimulates uterine contractions. On the other hand, oxytocin levels increase at high arousal and during orgasm in several inter-related ways. An example is sexual stimulation during parturition enhancing uterine contractions. Whereas an orgasm in the lactating woman can give milk outflow, breastfeeding can create pleasurable sensations in the uterine area and sometimes even orgasm.

Intra-partum pressure on the cervix and vaginal wall (by the penis, the examining fingers or the fetal head) causes an increase in oxytocin levels (the 'Ferguson reflex'), enabling bearing down.

Beta-endorphin, another neuropeptide with pain-reducing properties, has relations to birth and sexuality. Higher oxytocin levels appear to provoke ß-endorphin release, increasing the pain threshold. Outside and during pregnancy and labour, stimulation of the clitoris and anterior vaginal wall increases the pain threshold, especially when accompanied by orgasm.

2.5.2 Men

Testosterone plays a vital role in men, both for sexual desire, arousability (the ability to become 'horny'), sexual fantasy and spontaneous (nocturnal and early morning) erections.

Male T-levels appear influenced by reproduction and fatherhood. When a couple tries to conceive, the man will develop a monthly T-increase towards the middle of the woman's hormonal cycle.

In the second half of pregnancy, the male T-level will decrease (and in some men, the oestrogen level will increase), which can be a reason for lower sexual desire.

After the (first) birth, the T-level stays lower than before pregnancy, possibly making the man react better when the baby cries. So, male T-levels differ depending on the man's social role, being the lowest in young fathers, higher in childless partnered men and the highest in single men.

2.6 Sexual Response and Sexual Function

When Masters and Johnson started their research on sexuality in the laboratory, they described the visible sexual responses of the body in a model with arousal, plateau phase, orgasm and resolution [1]. Later, researchers added the phase of sexual desire. In common sexology, the plateau phase and resolution phases are rarely relevant, so one tends to use the model with desire-arousal-orgasm for sexual function. However, in pregnancy, the resolution phase is relevant because it coincides with the increasing genital hypercongestion.

Sexology defines physiological sexual arousal in humans as increased autonomic activation that prepares the body for sexual activity. It includes parasympathetic blood flow to genital and erectile tissues, particularly the clitoris, labia, vaginal epithelium and penis, and sympathetic blood flow from the heart to various striated and smooth muscles that participate in the sexual response [2].

Sexual arousal also includes a central component that increases neural 'tone' or preparedness to respond to sexual incentives. This is also called 'the arousability of the sexual system'. The person can perceive peripheral and central arousal as subjective sexual arousal, which can enhance the responsiveness of the genital tissues and influence specific copulatory responses, such as the latency to orgasm or ejaculation. In other words, more arousal, faster orgasm or ejaculation [4].

Between women and men, there are several apparent differences.

Desire Being relatively strongly determined by hormones, sexual desire tends to be higher in men (with their far higher T-levels).

Arousal Male genital arousal (erection) is unmistakable visible (present or absent), whereas many women even do not know if they are lubricated (wet) or not.

That corresponds with the erection as an essential part of the male identity. Having no erection 'when needed' makes many men insecure. Having no lubrication is, for women, far less critical. It can be remedied by saliva or another lubricant and usually does not impair her female identity. It can also cause pain, but that does not pose a significant problem if it does not become part of a vicious pain circle.

Orgasm in men is accompanied by a refractory period after which he cannot restart immediately, whereas an estimated 50% of women can have more than one orgasm in a short period.

Male orgasm easily happens premature ('too fast'), which, in women, is very exceptional.

2.6.1 Female Genital Sexual Response

Physiologic changes during sexual activity start with increased blood flow ('engorgement') to the genitals, causing vaginal lubrication (=lubrification or 'getting wet'). The vagina lengthens and dilates due to smooth muscle relaxation. The increased

blood flow to the clitoris increases intra-cavernous pressure, tumescence and protrusion of the glans clitoris, next to unfolding ('eversion') and congestion of the inner lips.

Outer lips When arousal in the nulliparous woman increases, the outer lips thin out and flatten against the perineum. The anatomic displacement of the outer lips is caused by a protrusion of the rapidly engorging inner lips and vasocongestion of the external third of the vagina. At orgasm, there is no change in the outer lips. After orgasm, involution of the outer lips occurs rapidly, returning them to their standard thickness and midline positioning. When arousal is maintained longer, the outer lips can become severely engorged with venous blood and sometimes even develop oedema, which may persist for several hours after cessation of all sexual stimulation. The outer lips react to arousal in the multiparous woman and become distended with venous blood. They increase 2–3× in diameter and hang swollen as a partial curtain to the vaginal outlet.

Inner lips At genuine arousal, they increase at least 2–3 times in diameter, adding to the clinical length of the vaginal cylinder. With increasing arousal, the colour of the inner lips changes from pink to bright red or a deep vine colour. This florid colouration diffuses along both sides of the vaginal outlet, usually including the clitoral hood area. The more intense the degree of pelvic and labial hypercongestion, the darker the colour. Short before orgasm, the inner lips form a turgid cuff, which narrows and elongates the outer third of the vaginal canal. The change of both lips results in opening the vaginal outlet by removing the natural anatomic protection of the vaginal orifice. The skin colouration signifies intense sexual arousal, clinically a sign of impending orgasm. After orgasm, the intense colouration of the skin returns from deep or bright red to light pink in 10–15 s. If the woman does not 'reach' orgasm, the colouration of the inner lips will fade rapidly, long before the resolution of the vasocongestive diameter increase.

The clitoris This is probably the only organ in the human body with the generation of pleasure as its only function (see Fig. 2.2). During sexual arousal, the central

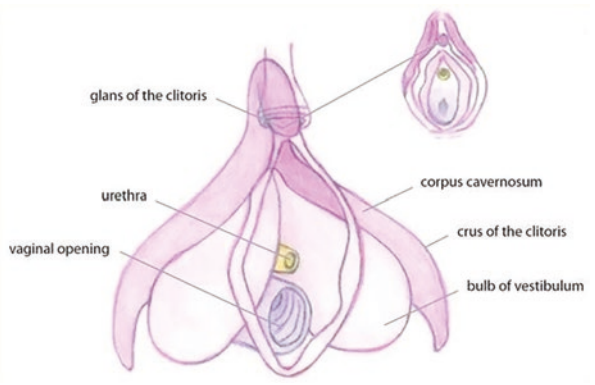

Fig. 2.2 The clitoris in the female anatomy. (Illustration composed by Gabrijela Simetinger and Helena Černej)

reduction of sympathetic tone and the release of vasodilator neurotransmitters increase the blood flow to the clitoris and relax the smooth muscles of the clitoral cavities, by which they are filled with blood. Sexual stimulation will cause the clitoral glans to become tumescent, with a speed depending on the intensity of whatever sexual stimulation is experienced. Once observable tumescence develops, the engorgement persists as long as any significant degree of sexual stimulation is maintained. Short before orgasm (in the plateau phase), the entire clitoral body (shaft and glans) retracts from its normal pudendal overhanging positioning. After orgasm, the clitoris returns to its normal position within 5–10 s.

The vagina Within 10–30 s after any sexual stimulation, the vagina produces lubricating fluid. Sexual stimulation causes the capillaries of the micro-circulation in the vaginal wall to fill with blood. The increased hydrostatic pressure forces plasma to transudate into the interstitial space around the blood vessels, causing the fluid passing through and between the cells of vaginal epithelium and leaking through the surface of the vaginal wall as vaginal lubrication ('getting wet'). With increasing sexual arousal, the inner two-thirds of the vaginal cylinder lengthens and distends, and the surface changes into a darker, purplish colour. During orgasm, the outer third of the vagina, pelvic muscles and anal sphincter contract powerfully in a regularly recurring (clonic) pattern. After orgasm, the vasocongestion disperses rapidly, and all the other changes disappear within 15 min.

The uterus In the late-excitement phase, the uterus and cervix are elevated upwards, away from the posterior floor of the vagina. This phenomenon, called 'tenting', is supposed to have a function in conception since in the ordinary ('missionary') intercourse position, it removes the cervix away from the expected 'sperm pool', which should prevent too early contact of the cervix with the not-yet-liquefied semen [9].

2.6.2 Male Genital Sexual Response

The penis, scrotum and rectum are very sensitive and respond to effective sexual stimulation by vasoconstriction and elevated muscle tone. During arousal, secretion comes from the bulbourethral (Cowper's) glands, which lie on each side of the urethra, and from the urethral glands, along the penile part of the urethra. This fluid lubricates the glans and can show (as 'pre-cum') before ejaculation occurs. Living sperm is regularly found in this fluid, making the withdrawal method of contraception (coitus interruptus) risky.

In the uncircumcised man, the foreskin can, during erection, become partially retracted along the elongated penile shaft, exposing the tip of the glans and urethral orifice. During penetrating, the foreskin of the uncircumcised penis usually glides backwards, allowing the slippery glans to enter without pain for both woman and man.

Erection Sexual stimuli cause parasympathetic signals to the muscular fibres in the cavernous body. Their relaxation causes engorgement with blood that first creates fullness and then hardness due to the tight encapsulation of the tunica albuginea and the compression of the veins.

Ejaculation This occurs under sympathetic control. The sperm starts from the epididymis, gets supporting additions from the seminal vesicles (alkaline) and the prostate, and is forcefully expelled to and through the urethral meatus. Regularly recurring contractions take place in the bulbospongiosus, ischiocavernosus and transverse superficial and deep perineal muscles and the urethral sphincter, with ejaculatory contractions involving the entire length of the penile urethra. After ejaculation, penile detumescence occurs. After ejaculation follows a refractory period, which is needed for restoring the supporting fluids for the sperm cells.

Orgasm For experiencing orgasm, a signal is sent from the centres in the spinal cord to the brain. Though most men consider orgasm and ejaculation identical, they are not. A few men can have several orgasms in a row as long as there is no ejaculation.

Semen An average ejaculation is 5 mL (i.e. two teaspoons) and contains 20–150 million sperm cells per mL. Yet ±70% comes from the seminal vesicles and ±30% from the prostate. That is why, after vasectomy, the man does not have less semen.

2.6.3 Extragenital Sexual Response

The human physiologic response to sexual stimulation involves many areas other than the primary or secondary organs of reproduction. Physical signs of sexual arousal occur in the entire body, with superficial and deep vasocongestion and generalised and specific myotonia. Generalised muscle tension appears in the hands, feet and abdomen, and specific muscle tension in the bulbospongiosus and ischiocavernosus muscles and the rectal sphincter.

The female breasts The first sign of arousal is the erection of the nipple (in full arousal, an increase of 5–10 mm) and an increase in venous flush, shown as a skin rash. Later in arousal, the areola becomes swollen, by which the nipple erection seems to diminish. With full arousal, the breast volume can increase by 20–25%. After having breastfed one baby, that increase in volume during arousal is less. After having nursed two babies, there is no more arousal-related volume increase. Before orgasm, a maculopapular rash appears over the epigastrium and the breast surface. After orgasm, the skin rash quickly disappears, just as the areolar swelling, by which the nipple erection seems to return.

The male breasts In part of the males, nipple erection and tumescence can happen. In half of the men, stimulation of the nipples increases their arousal.

In both sexes, the superficial vasocongestive reaction is called sex flush. This sex flush can spread over the breast, lower abdomen, shoulders and even the inner skin of the elbows (antecubital fossa) when sexual arousal mounts. After orgasm, it disappears.

High muscular tension (myotonia) is seen late in the arousal phase, both generalised and specific. Various muscles contract with regularity or involuntary spasms, but the contractions are frequently also voluntary, depending on the coital position.

In women, the external meatus of the urethra can show occasional involuntary widening during orgasm. Due to the nulliparous structures (firm perineum and constriction of the vaginal outlet), the posterior wall of the urinary bladder can be irritated by penile thrusting, causing postcoital dysuria, a complication sometimes known as 'honeymoon cystitis'.

During the arousal phase, voluntary contractions of the external rectal sphincter are visible in women and involuntary contractions in men. Involuntary contraction of the rectum occurs during orgasm and ejaculation in both sexes.

Hyperventilation, tachycardia and elevation of systolic blood pressure increase directly when sexual arousal increases. Involuntary perspiration may develop during the post-orgasmic phase independent of the degree of physical activity.

2.7 Sexual Response in Pregnancy

Pregnancy markedly increases the vascularity of the pelvic organs. The fetal support system creates gross vasodilatation in the female pelvis. Any physiologic response to sexual stimulation on top of that further increases the massive pelvic vasocongestion. That superposition of sexual arousal on top of pregnancy hypercongestion can reach high levels during the second and can continue well into the third trimester. During the second trimester, part of the pregnant women has an increase in sexual drive, with more need for coital and other sexual stimulation and sometimes intense orgasmic experiences. The female reproductive organs alter significantly during pregnancy. Those changes are predominantly related to intense generalised pelvic vasocongestion. Therefore, the vasocongestive response is a much more significant factor in pregnancy than the development of myotonia. During arousal, both inner and outer lips become very engorged, with the outer lips even becoming edematous. Towards the end of the first trimester, there is a definitive increase in the production of vaginal lubrication, which continues throughout pregnancy. After elevation of the uterus into the abdomen, sexual stimuli cause the same vaginal expansion and distension as in the non-pregnant state. The further pregnancy develops, the more severe the venous engorgement of the entire vaginal barrel becomes, and the more advanced the secondary development of the orgasmic platform in response to sexual stimulation. It can develop to such an extent that the lateral vaginal walls meet in the

midline in severe vasocongestive response to high sexual excitement, with the entrance sometimes becoming completely anaesthetic or painful.

One can observe orgasmic platform contractions as specific physiologic evidence of orgasm during the first and the second trimester of pregnancy. During the third trimester, one can barely observe them because of the vasocongestion of the vulvar entrance, although the woman subjectively feels the contractions.

Whereas regular, clonic contractions typically accompany an orgasm, the contraction pattern can change into one long-lasting tonic contraction during the last trimester. Spastic contraction may occasionally cause fetal heart tones to become slower, but this reaction is transitory. No further evidence of fetal distress has been demonstrated.

After orgasm, the pelvic vasocongestion is not entirely relieved (in other words: there is no complete resolution). The pregnant women who is in the Masters and Johnson laboratory study repeatedly got an orgasm did not get complete relief from their sexual arousal levels for a significant time, although their orgasms were objectively most intense and subjectively quite satisfying [1].

In the second and third trimester, residual pelvic vasocongestion and the high 'pelvic pressure' (of the heavy uterus) may cause maintained high levels of sexual arousal in part of the women.

2.7.1 The Breasts

During the first trimester, the breasts rapidly increase in size due to the developing vascular and glandular beds. When the nulliparous woman responds to sexual stimuli in the first trimester of her pregnancy, venous congestion of the breasts is more evident than in a non-pregnant state. This superposition of sexual arousal and pregnancy can cause pain frequently localised in turgid nipples and engorged areolar elements. During the second and third trimesters of pregnancy, there is less reduction in breast tenderness. Reactions of nipple erection and areolar tumescence remain constant through all three trimesters of pregnancy.

2.8 Post-partum Physiology and Sexual Response

Immediately post-partum, many changes occur with critical roles for uterine involution and hormonal switches and, in addition, many hormonal consequences for the breastfeeding woman.

The weight of the uterus decreases from 1.000 g immediately after birth to 500 g after 1 week and back to 60 g in 6 weeks. Extensive venous congestion accompanies that process, responsible for the 'full feeling' comparable to the hypercongestion in the second and third trimester. For some women, this appears to promote sexual feelings [1].

The high levels of oestrogen and progesterone during pregnancy decrease towards the end of pregnancy to drop sharply after birth. With expelling the placenta, the placental hormones disappear, causing a steep increase in prolactin levels, which, without breastfeeding, will be back to pre-pregnancy levels in one week. For the other women, breastfeeding will cause high prolactin levels. Prolactin directly diminishes sexual desire. It keeps the oestrogen levels low, causing vaginal atrophy and the T-levels low, causing low desire and arousability, fatigue and low mood.

Although this sounds rather bleak for part of the breastfeeding mothers, the outcome is more favourable for others. Breastfeeding has a dual effect on sexuality, causing for some an increase in sexual sensations and even orgasm, or an increased sense of femininity and partner contact. Other women can be so absorbed by the intimacy with the baby that sexuality seems forgotten. The outcome can be somewhat problematic when that gets combined with vaginal atrophy and low arousability and a partner who needs penetration sex to solve his internal tensions.

2.9 Conclusion

One can read this extensive explanation of anatomy, physiology and endocrinology just as an additional technical package of knowledge for reproduction healthcare professionals. However, this chapter also intends to increase awareness of the simultaneous multitude of influences these processes can have on sexuality and intimacy. Sexuality and reproduction are, after all, very strongly intertwined.

The choreography of birth, a female sexual encounter and breastfeeding have many aspects in common. It is not surprising that some women experience birth (nearly) as an orgasm, some women have experienced an orgasm just because of breastfeeding and breasts can start leaking during sexual arousal. In the same way, it is not surprising that oxytocin, the essential ‘bonding hormone’ in breastfeeding, also increases during sexual play and orgasm.

Thus, adequate knowledge of the sexual system’s functioning seems relevant for midwives and obstetric HCPs to adequately address the sexual health needs of the woman and the couple from pre-conception through young parenthood.

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