NOWOTWORY Journal of Oncology
2020, volume 70, number 5, 211–219
DOI: 10.5603/NJO.2020.0042

ISSN 0029–540X
www.nowotwory.edu.pl

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The surgical anatomy of the mammary gland (part 1.)

General structure, embryogenesis, histology, the nipple-areolar complex, the fascia of the glandular tissue and the chest wall

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The rapid development of surgical techniques used in breast surgery requires an excellent knowledge of mammary gland anatomy. This article presents the most up-to-date information on embryogenesis as well as the histology and general anatomy of the breast. Particular attention has been given to the structure of the nipple-areolar complex and the anatomy of the chest wall and mammary gland fascia.

Key words: mammary gland, anatomy, embryogenesis

The breasts are paired glands located on the front wall of the chest within the outer integument. They can be found both in females and in males, although they are an anatomical attribute of women in a cultural, mental and, above all, functional sense. Anatomical descriptions of female breasts refer to some kind of a 'model'. In the majority of them, this model is purely theoretical and most often refers to the breasts of young women with a healthy weight and body structure, soon after achieving sexual maturity. Thus, it reflects the perfect breasts of an ideal woman. This ideal has been changing significantly over the centuries. Moreover, it differs depending on race, geographic or regional location, or subculture. Therefore, it is difficult to define the right size of universal breasts. It is more appropriate to describe the size and shape of breasts individually with reference to the harmony with the woman's build as well as the structure and shape of her chest. It may be assumed that the average capacity of a breast remains within the range of 200 to 500 ml.

Female breasts are subject to continuous changes dependent on a number of endogenous factors (primarily hormones), general health condition or disease, as well as exogenous factors related to the nature of physical activity, work, care, reproduction or breast feeding. Natural changes in the anatomy of the mammary gland arise with the age and successive stages of maturity reached by each individual.

The breast of a sexually mature woman is primarily made of glandular tissue which is subject to dynamic cyclical hormonal changes caused by alternate stimulation with oestrogens (the first phase of the cycle) and progesterone (the second phase of the cycle). Pregnancy is the period when glandular tissue is stimulated to grow and prepare for feeding under the influence of prolactin. The breast of a woman after menopause is filled to a large extent with adipose tissue, which is less susceptible to hormonal changes [1, 2].

How to cite:
Cieśla S, Wichtowski M, Poźniak-Balicka R, Murawa D. *The surgical anatomy of the mammary gland (part 1.). General structure, embryogenesis, histology, the nipple-areolar complex, the fascia of the glandular tissue and the chest wall.* NOWOTWORY J Oncol 2020; 70: 211–219.

Because of the location on the front wall of the chest within the outer integument, there is a significant variety as regards the position and shape of mammary glands depending on the body position, the size and weight of the breasts as well as the woman's physical activity. Differences in the number and location of hormone receptors within the breast and the influence of external factors during each individual's development may often cause asymmetry between both breasts [1, 3, 4]. The aforementioned factors justify the special need for knowledge of breast anatomy, both static and dynamic. Regardless of the type of intervention planned (treatment or cosmetic surgery), a surgeon who embarks on surgery within the mammary gland must examine in detail the abovementioned anatomical aspects and predict the impact of the procedures performed on the changes occurring in the operated breast with the passage of time.

General structure

A breast has a conical shape and is located between the pectoralis major muscle, subcutaneous tissue and the skin. The back wall of the breast has contact with the fascia of the pectoralis major, the serratus anterior, the abdominal external oblique muscle and the rectus abdominis. The breast foundation is an oval with the diameter of 10–12 cm stretched towards the axillary fossa. The location on the chest wall is relatively stable and involves the area stretching between the anterior arch of the 2nd and 3rd rib from the top and the anterior arch of the 5th and 6th rib from the bottom as well as between the sternal line medially to the ancillary midline laterally [5, 6].

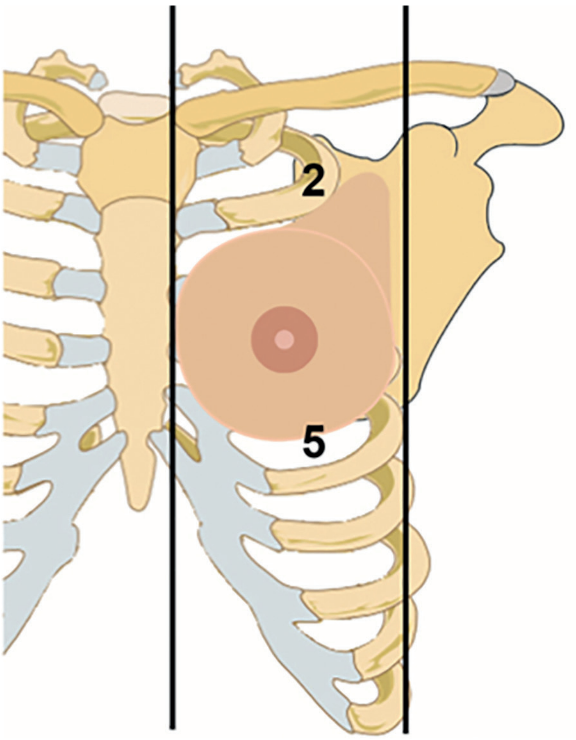


Figure 1. Projection of a breast on the chest front wall (footprint)

There are three main components of a breast: glandular tissue (*glandula mammaria*) covered with the skin, the nipple (*papilla mamariae*) and the areola (*areola mammae*) [7]. Glandular tissue is made of several lobes (*lobi glandulae mammariae*) arranged radially and divided by septa made of connective tissue and adipose tissue. The densest glandular tissue is in the top external quadrant and it extends towards the ancillary fossa creating Spence's tail. The main exosecreting ducts (*ductus lactiferi*) run from glandular lobes to their separate ostia at the top of the nipple. Except for the areola and the nipple, subcutaneous tissue (*tela subcutanea*) completely surrounds glandular tissue. For a long time, part of the subcutaneous tissue was considered superficial fascia, which, in the form of two laminas, surrounded the breast. In fact, the superficial fascia of the chest is located between the breast and the deep fascia of the pectoralis major [5, 6, 8]. In subcutaneous tissue, in particular in the top part of the breast, there are numerous fibres and hypocellular septa made of connective tissue running from the skin inward, between lobes and lobules of glandular tissue. They are attached to the fascia of the pectoralis major. These structures, responsible for maintaining the breast in the appropriate position on the chest wall, are called the suspensory ligaments of Cooper [9]. The development of a tumour within the mammary gland may cause the infiltration of these ligaments and the retraction of the skin above the tumour [10, 11].

Mammary gland development

The embryonic period

Embryonic breast development, joint and identical in female and male foetuses at the initial stage, involves a number of successive interactions between specialised groups of cells. The human skin coat is made of two layers, the epidermis and the dermis, which create diverse structures to ensure appropriate interactions of the body with the external environment.

Initially, the epidermis is created out of the superficial layers of the ectoderm which are colonised by three structures:

1. the pigment containing melanocytes from the primordial neural tube,
2. antigen-presenting Langerhans cells from the bone marrow,
3. Merkel cells of unknown origin which receive sensations related to pressure from the surface.

The dermis, which is originally created from the mesoderm, contains numerous blood vessels and sensory nerve endings.

In 4th week of foetal life individual groups of superficial ectoderm cells become thicker and, at the same time, their proliferation towards mesoderm cells located at a greater depth begins [6, 5, 12, 13].

They undergo intense differentiation to create the multi--layer skin of a mature human being. The highly specialised structures created from different skin layers include: teeth, hair, hair appendages, nails, sebaceous glands, apocrine glands, sweat glands and mammary glands. The latter three are formed from the processes of the epidermis penetrating the dermis in the form of diverticula.

Apocrine and sweat glands are located primarily in the area of axillae, the anus and genitals. Mammary glands are a special type of highly specialised apocrine glands. Their development begins in week 4th of foetal life with the double thickening of the ectoderm in the ventral part of the embryo, which forms the mammary line (milk line) running along an arch from the axilla to the groin area on both sides. In the human foetal development these structures disappear quickly, except for the primordia of mammary glands formed on both sides at the level of the 4th intercostal space on the front wall of the chest. In week 5th, the remaining part of the ectoderm line begins to proliferate into deeper levels of the skin. In this way, a primordial breast bud is created [14].

In weeks 6–7th the ectoderm diverticulum continues to actively grow into the dermis until in week 10th the primordial breast bud divides itself into branches which, in week 12th, create the secondary breast bud – a form of a lobule in a mature breast. The abovementioned process is induced by the extracellular mesoderm matrix. Growth factors and hormones produced by this and by adipose tissue, which is a lipid deposit, stimulate the development of the primordial breast bud.

In the next stage of the foetal development, which lasts until week 20th, the secondary buds of the glandular tissue primordia become extended and they branch out into narrow channels that will eventually form lactiferous ducts (*ducti lactiferi*). This stage of breast development is induced by placental hormones that pass through to the foetus: progesterone, the growth hormone, the insulin-like growth factor, oestrogens, prolactin, corticoids of the adrenal cortex and triiodothyronine. The result of this stimulation is the formation of the glandular tissue lobules that contain their own exosecreting lactiferous ducts [1, 12, 13]. Support for the forming breasts is provided by the process of skin raising and the creation of the suspensory ligaments of Cooper that anchor the breasts in the fascia of the pectoralis major. Exosecreting lactiferous ducts converge radially in the retro-areolar area creating a kind of a collective bubble, a recess and an opening in the skin. In this place, as a result of the growth of the ectoderm into internal layers of the mesoderm, the latter becomes stimulated to create an evident protrusion on the skin – a breast nipple bud. It contains numerous smooth muscle fibres arranged longitudinally and circularly. The areola surrounding the nipple with its specialised apocrine epidermal Montgomery glands is formed from the ectoderm in the 5th month of foetal life. A pigmentation process begins in the nipple in week 32th and lasts until the end of the pregnancy [3, 6, 14].

Four stages of extra-foetal breast development

The neonatal period

The breast of a neonate is built of radially arranged lobules. Their lactiferous ducts converge into a bubble and discharge in the nipple. At this stage, the nipple is a protrusion with a little recess in the central part of the areola. Soon after the delivery, the nipple, as a result of the proliferation of the neighbouring tissues, becomes raised permanently and the areola becomes slightly pigmented. The early stages of breast development to a small extent depend on steroid sex hormones. However, strong testosterone stimulation in males through the binding of mesoderm receptors causes a rapid involution of glandular tissue and hampers breast development during the neonatal period. At the same time, oestrogens stimulate further breast development and maturation in females [1, 13].

Puberty

Puberty is characterised by intense breast growth. Initially, it is the growth of deposit adipose tissue and periductal connective tissue, which is followed by the growth of glandular tissue and the extension and elongation of breast ducts. This happens under the stimulation of oestrogens, the growth hormone and prolactin, without the participation of progesterone. Usually, breast development in women ends about the age of 20 [1, 14].

Pregnancy

During pregnancy, breasts achieve functional maturity by the preparation of follicles to active lactation. Under the influence of the continuous growth of the blood levels of such hormones as progesterone, oestrogens, prolactin and placental lactogen, cytoplasmatic organelles accumulate in the epithelial cells of the follicles. After the delivery, environmental factors and intensive hormonal changes (prolactin produced in the pituitary and somatomammotropin produced by the placenta) stimulate lactocytes to produce milk containing proteins, casein and alpha-lactalbumin as well as lipids. Under the influence of the neonate's crying and sucking as well as oxytocin, which is produced in the hypothalamus and released from the posterior lobe of the pituitary, the muscle cells surrounding the follicles begin to contract. Consequently, milk is released from the nipple [15, 16]. When feeding ends, the production of milk also disappears as a result of the lesser mechanical stimulation of breasts and the reduction of prolactin levels. Follicles go back to rest.

Menopause

Decreasing hormonal stimulation during menopause (after 40 years of age) leads to the permanent rest of breasts and the disappearance of glandular tissue, which is replaced by connective and adipose tissue.

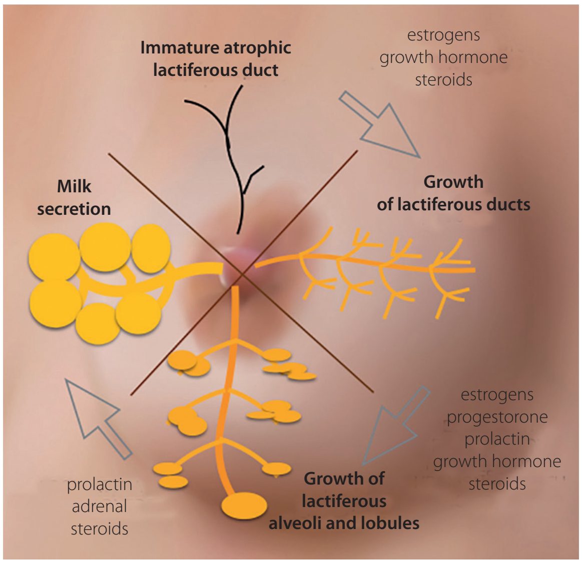


Figure 2. The influence of hormonal stimulation on the maturation of the breast gland

Anatomical disturbances of the breast development

There are many kinds of breast structure disturbances related to developmental defects. One of the most common (affecting 1–5% of the population) is the incomplete involution of the embryonic mammary line in the form of hyperthelia, i.e. the remnants of accessory elements of the areola and/or nipple along the mammary line. Polymastia, i.e. the presence of additional mammary glands, is a much rarer condition. They may appear along the entire course of the mammary line, from the axillary fossa to the groin. Because of the colour of the areola and the nipple, they may be mistaken for dermal papillae or naevi. Hypoplasia, i.e. the underdevelopment of breasts, or amastia, i.e. the absence of glandular tissue within the nipple-areolar complex, occur very seldom. Amastia, most often one-sided, is accompanied by the total absence of the pectoralis major. Another structure disturbance is one-sided amastia as an iatrogenic effect of surgery or radiotherapy. When the process of embryonic development is stopped or disturbed at the stage of the second breast bud creation (weeks 12–16th), the areola takes on the shape characteristic for a tubular breast. It is accompanied by a significant reduction in the connective tissue volume (parenchyma) and a kind of hernia – the prolapse of glandular tissue with the frontward expulsion of the nipple-areolar complex [1, 3–5, 13].

Histology of the mammary gland

The glandular tissue is made of follicles (*alveolus lactiferi*) grouped in grape-like bunches (*acinum lactiferi*) which together form the basic functional unit of the breast – the lobule (*lobulus*). Lobules are joined in bigger structures forming lobes (*lobus*). Both lobules and lobes are surrounded by a kind of septa made of connective tissue, which becomes thicker around lobes. It is difficult to identify precisely the boundaries of lobes for the needs of segmental mastectomy.

Follicles are made of two layers of cells: the internal layer on the side of the follicle lumen – lactocytes secreting milk during lactation, and the external layer made of muscle-epithelial cells.

Lactiferous ducts which start in lactiferous follicles come together creating interlobular ducts, which form interlobar ducts and finally main ducts beginning at a distance of about 8 mm from the areolar surface. They run almost parallel to the ostia in the form of lactiferous orifices at the top of the nipple. The walls of the lactiferous ducts are made of flexible connective tissue containing a large number of elastic fibres arranged circularly or longitudinally and smooth muscle cells. The subcutaneous tissue of the areola contains a large number of radially arranged smooth muscle fibres. In the nipple, smooth muscles have a spiralling course and create a net at the top. The main lactiferous ducts pass through the openings in this net.

From the histological perspective, there are two components building the breast: epithelium and stroma. The duct--lobule system is based on two layers of epithelial cells lying on the basal lamina and surrounded with a stroma. Epithelial cells (luminar) create a layer of cubic, pseudo-striated cells located internally – on the side of the lumen of exosecreting ducts. The other, more external layer, is created by myoepithelial cells lying directly on the basal lamina.

The basal lamina surrounding lactiferous ducts, ductules and grape-like structures of the mammary gland made of type IV collagen and laminin separates the system of ducts from the surrounding stromal tissue. The infiltration of the basal lamina and myoepithelial cells by the cells of an invasive tumour is what distinguishes it from the non-invasive ductal carcinoma *in situ* (DCIS) [6, 13].

There are two kinds of stromal tissues:

1. Intralobular tissue – contains loosely placed fibroblasts, dispersed lymphocytes, macrophages, plasmatic cells and blood vessels. This tissue does not contain elastic fibres, it is rich in mucus and responds to hormone stimulation.
2. Interlobular tissue – forms the connective tissue surrounding bigger lactiferous ducts containing more collagen fibres which are more densely arranged. Because of its greater density, this tissue causes difficulty in interpretation during mammography. This part of the mammary gland is replaced by adipose tissue during menopause and bears the main responsibility for the increase of the breast volume.

Within the stroma, one can find multi-nucleus giant cells that may raise concern for oncological reasons, but their clinical significance has not been proven [17, 18]. Lymph nodes may also be found inside nipples – most often they are incidentally diagnosed during a histological examination of a removed breast. If any carcinogenic changes are confirmed, they are classified as axillary lymph nodes according to the TNM Classification.

The skin of the nipple-areolar complex contains melanocytes with a different level of pigment saturation. Usually, pigmentation reaches its peak in the period of sexual maturity. A precisely marked pigmentation border between the areola and the rest of the skin on the breast is a convenient place for a surgical incision. Scars in this place are usually linear and do not leave any visible traces. The areola skin contains numerous sebaceous glands, independent of hair follicles, which take the form of Montgomery's tubercles, especially visible during pregnancy and lactation. Apocrine glands are also present. Moreover, the fibrous stroma contains numerous strands of smooth muscles.

In 10% of women, there are clear cell (Toker) structures within the epidermis of the nipple, which in 27% of cases exhibit the qualities of metaplasia and in 12% – atypia [52]. They may be the reason for the mistakes made when distinguishing it from the clear cell DCIS variant.

Breast skin and the nipple-areolar complex

The skin covering the mammary gland has a diverse structure. It is thicker at its perimeter, while near the areola it is thinner and more delicate. In the peri-areolar area there is no subcutaneous fat and the skin is attached to the glandular tissue by suspensory ligaments, subcutaneous muscles and nipple muscles distributed circularly around the ostia of lactiferous ducts at the top of the nipple. The skin is particularly thick and strong at the bottom part of the breast near the inframammary fold. The quality of the skin covering the breast may differ depending on the individual. In some women it is thin, flaccid and has little elasticity. This is always accompanied by the loosening and extension of the suspensory apparatus and its susceptibility to increasing ptosis [1, 11, 19]. In such a situation, during breast reduction or breast suspension surgery it is necessary to ensure that the distance between the rim of the areola and the inframammary fold be adequate. Special caution is advised when the epidermis near the areola is removed as subcutaneous blood vessel plexuses may easily be damaged because of the skin thinness in this area [19].

The areola of a medium-size breast has a wheel-like shape with the diameter of 3.5–5 cm. In the projection upon the chest wall, it is located at the level of the 4th intercostal space. What makes it different from the surrounding skin is a greater concentration of the pigment and the presence of minor protrusions (1–2 mm of the diameter of Morgagni tubercles) in the form of ostia of apocrine sebaceous glands moisturising the skin surface, also known as Montgomery glands [1, 20].

In the central part of the areola there is a nipple, i.e. a protrusion which differs individually and most often has a conical or cylindrical shape with a diameter of 10–12 mm and a height of 9–10 mm. The recesses on its surface are the ostia of exosecreting lactiferous ducts in the number equal to the number of mammary gland lobes [1, 3].

It was universally considered that each part has 15−25 lobes and the same number of lactiferous duct ostia. Recently, authors have reported that there are 9 lobes and ducts on average discharging to the nipple of each breast. The existence of milk containers in the form of lactiferous sinuses located behind the nipples is also challenged at present [11]. The skin of the nipple-areolar complex does not lie on the subcutaneous tissue but on the thin layer of smooth muscles forming two layers:

- The layer of spirally circulating exosecreting lactiferous ducts (Sappey muscle fibres)
- The radial layer forming a net (muscle fibres of Meyerholz).

The above muscle fibres run from the areola to the nipple and accompany exosecreting lactiferous ducts along their entire length [20].

The layer under the muscles below the areola is made of adipose tissue, which disappears towards the nipple. The sub-areolar vessel plexus is located in this tissue. Lactiferous ducts that start in lactiferous follicles converge to create, in turn, interlobular, interlobar and finally main ducts that begin at a distance of about 8 mm from the areola surface and run almost parallel to the ostia at the top of the nipple. The epithelium of exosecreting ducts extends to reach directly the skin of the nipple [3, 10, 11]. This creates a possibility for the carcinoma to proliferate using this path. The nipple-areolar complex includes a developed network of blood vessels, sensory nerve endings, smooth muscles containing the sympathetic system fibres and a developed network of lymphatic vessels also known as the Sappey plexus [21, 22].

Breast and chest wall fascia

The notion of fascia, which was considered a passive structure surrounding muscles, has undergone a radical change. Today, on the basis of the studies of anatomists and clinicians, it is known that the fascia is a dynamic tissue, highly innervated and well-vascularised. The *fasciae* surrounding organs are also

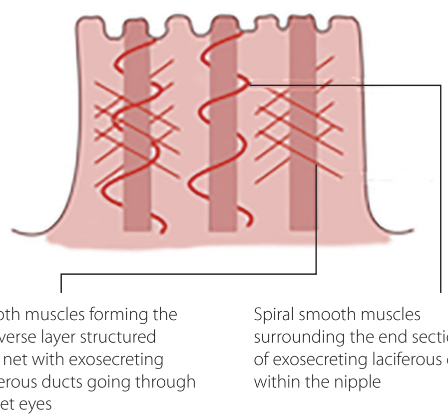
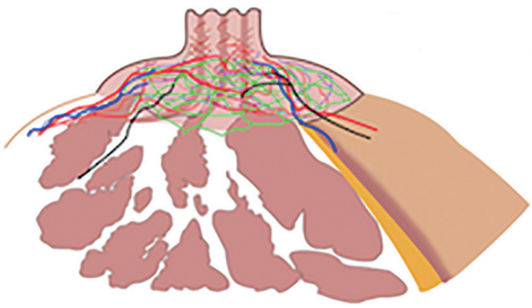


Figure 3. Types of smooth muscular coat surrounding exosecreting laciferous ducts within the nipple



— Sappey's lymphatic subareolar plexus
— Subareolar arterial plexus
— Subareolar venous plexus
— Subareolar nerve plexus
Sensory and autonomic sympathetic fibres

Figure 4. Cross section of the nipple-areolar complex

a source of multi-potential stem cells supporting the process of tissue repair and healing. Thorough understanding of the structure of superficial and deep fascia and its clinical significance is of key importance in breast reconstruction and aesthetic surgery.

There are significant differences between the superficial fascia (*fascia superfitialis*) and the deep fascia (*fascia profunda*) in terms of their morphology and function.

The superficial fascia is a membranous layer of connective tissue made of loosely braided collagen fibres mixed with elastic fibres, abundant in this structure. It is connected to the skin by vertical fibrous threads called retinacula (ligaments, *retinacula cutis*). Below, between the superficial and deep fascias, there is another layer of reticula arranged obliquely to the fascia. In this space, there are numerous adipose tissue lobules.

The subcutaneous layer performs the following functions:

1. enabling the skin to move over the structures located underneath it,
2. thermoregulation,
3. exchange of metabolites,
4. passage of blood vessels, lymphatic vessels and nerves.

The superficial fascia is an equivalent of the muscular layer of the skin (*panniculus carnosus*) present in mammals. Also in some areas of the human body there is a muscle coat within the superficial fascia: on the neck (platysma), on the face (superficial muscular aponeurosis system – SMAS), near the anus (external sphincter, *fascia perinealis superfitialis – Colles fascia*) and in the scrotal sac (*fascia dartos – tunica dartos*) [5, 23].

The deep fascia is located under subcutaneous tissue and covers muscles as a multilaminar layer of collagen interwoven with relatively insignificant numbers of elastic fibres. Extensions of deep fascia penetrate muscular tissue in the following forms:

1. intermuscular septa *(septi intermusculari*),
2. epimysium,
3. perimysium,
4. endomysium, and in some regions
5. periosteum.

Muscular fascia is inherently integrated with muscular tissue. It participates in the transfer of the contraction force between related muscle groups.

Because of the accumulation of nerve endings in the form of mechanoreceptors, the deep fascia plays an important role in deep sensibility (proprioceptive).

There are differences in the structure of the deep fascia depending on its location. The deep fascia of the upper limbs, lower limbs and the lumbar-sacral area is thick, strong and able to transfer significant forces during muscle contraction. The fascia covering the superficial muscles of the chest wall (pectoralis major, muscle latissimus dorsi, trapezius muscle) is thinner, more delicate and makes a uniform layer, difficult to separate from the chest muscles it covers.

The fascia adheres to muscles thanks to numerous fibrous intermuscular septa to which individual muscular fibres are attached, which additionally improves the efficiency of muscle contraction.

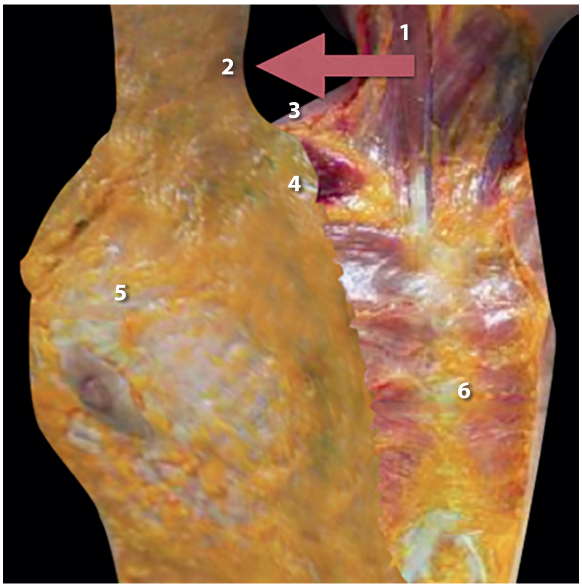
In the course of embryonic development, the superficial muscles of the chest transfer from the upper limb to extend over the chest muscles that lie deeper. In this way, they create an additional fascial-muscular layer. This explains the functional identity of the superficial muscles of the chest and the upper limb and the existence of muscular-fascial connections between limbs [23].

The mammary gland is located on the front wall of the chest and lies on the fascia of superficial muscles (greater pectoral muscle, serratus anterior). The superficial layer separating glandular tissue from adipose tissue is an important anatomical element in breast surgery. Surgical preparation of the surface of glandular tissue between the subcutaneous and pre-glandular vessel plexuses ensures radical removal of glandular tissue and, at the same time, enables surgery in the area devoid of blood vessels [24].

The skin and superficial fascia are connected with the deep fascia by a system of fibrous retinacula called the ligaments of Cooper. They are largely responsible for the fixation of the mammary gland to the skin. This is why there is no mobility of the skin with respect to the mammary gland [25, 26].

So far, it has been thought that the first person who described the existence of suspensory ligaments of the breast in 1840 was Sir Astley Paston Cooper (1768–1841) [9].

It turns out, however, that the detailed anatomical description of the breast with the entire ligament apparatus was provided 300 years earlier in the first edition of *De Humani Corporis Fabrica Libri Septem* published by Andreas Vasalius in 1543. He described the existence of three structures: a thin fascial membrane, dense adipose tissue between the breast and the chest wall muscle and numerous little fibres running vertically from the abovementioned structures to the skin [27–29].



1. Neck muscles
2. Platysma
3. Superficial fascia of the chest
4. Subcutaneous adipose tissue
5. Nipple-areolar complex
6. Intersection of the collagen fibres of superficial fascia over the sternum

Figure 5. Chest wall with dissected superficial fascia, subcutaneous tissue, adipose tissue and a mammary gland

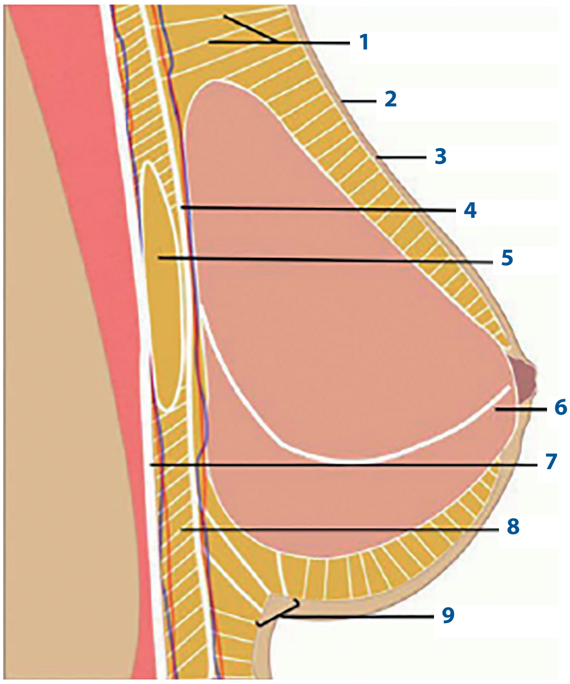
Between the lamellas of the superficial and deep fascias, directly behind the mammary gland tissue, there is a space filled with bursa which is a fatty-serous pillow (*bursa retromammaris,* Chassaignac's bursa). Numerous connections with the ligaments of Cooper make it possible for the fascial lamellas to move freely in this place, which enables the transfer of breasts on the chest wall [23, 30, 31].

The most important fascial component is the inframammary fold located near the lower edge of the greater pectoral muscle. Its detailed anatomical description was provided by Riggio (2000) on the basis of his own studies and earlier experiments by Lockwood (1991) and Navy (1998). The key element of the inframammary fold is a system of numerous subcutaneous connections in the form of strong retinacula (ligaments) between the superficial and deep fascias, which are evidently thicker in this place and create a dense adherence zone [8, 31].

Surgical preparation of tissues during skin sparing mastectomy (SSM or ASM – areola sparing mastectomy) in order to create a pocket under the pectoral muscle in immediate breast reconstruction (IBR) requires that the entire length of the inframammary fold structures and deep fascia along the lower edge of the greater pectoral muscle be preserved. Any damage to these structures may preclude immediate breast reconstruction with the application of a final implant. Preserving the entire fascia of the greater pectoral muscle during mastectomy due to carcinoma is oncologically safe. Preserving undamaged fascia in the lower-medial (parasternal) part prevents the loosening of the muscle attachment, which ensures even covering of the implant and makes it possible to place sutures in the lateral part at the border of the greater pectoral muscle and the serratus anterior muscle to prevent the implant from slipping to the side [8, 31, 32].

Anatomical studies indicate there is a close relationship between the course of main vessels and nerves inside glandular tissue and the fascial apparatus inside the breast preserving its shape and form and fixing the breast on the surrounding structures of the chest wall. This kind of an internal suspensory ligament of the breast is made of a horizontal dense fibrous septum which starts on the breast fascia at the height of the fifth rib and runs transversely to the nipple-areolar complex. The septum divides the mammary gland into two levels, upper and lower. At both ends of the septum, there is a fibrous tissue reinforcement in the form of a medial and lateral ligament whose fibres are folded at the edges and run vertically to the chest wall. These are recurring structures with consistent and defined morphology.

The vertical medial ligament extends from the strong fascia of the sternum at the level of the attachment to the 2nd and 5th rib, while the lateral vertical ligament is attached to the lateral edge of the smaller pectoral muscle. Cranially vertical ligaments attach to the breast fascia at the height



1. Superficial fascial-cutaneous ligaments
2. Epidermis
3. Dermis
4. Superficial fascia
5. Chassaignac's bursa
6. Vertical fascia of the breast – mesentery
7. Deep fascia
8. Deep interfascial ligaments
9. Inframammary fold

Figure 6. Draft of the breast gland fascia

of the second rib and in this way create an oval attachment. The lines of this attachment extend along the edges of the greater pectoral muscle. In the ventral direction, both lateral and medial ligaments enter glandular tissue creating a fibrous sac surrounding the breast [12, 31]. Most authors think that the superficial lamella of the chest fascia lies entirely on the pectoral muscle outside glandular tissue. Some of them believe that the superficial fascia is divided at the top edge of the breast into a deep lamella – extra-glandular, and superficial lamella – pre-glandular, which encapsulates the entire breast. Even the members of the latter group admit that only a part of the superficial lamella can visible at the edge of the mammary gland, which is where it connects to the deep fascia forming the crests of Duret as a direct extension of the ligaments of Cooper running from the chest wall directly toward the skin. These minor ligaments determine the real range and shape of the breast. In the medial part, the ligaments are more delicate and support the skin directly above the sternum. In the lateral part, they are strong, more developed and form a strong band between the lateral edge of the smaller pectoral muscle, the skin and the axillary fascia. In this way, employing the suspensory ligament of the axilla they create the vault of the axillary fossa [23, 32].

The inframammary fold is made of the superficial part of fascia, close to the skin, which extends transversely at the level of the 5th rib thanks to the ligaments of Cooper accumulating in the greatest numbers there. Apart from suspending the mammary gland on the chest wall and shaping the breast, the suspensory ligament system creates a pathway for vessels and nerves entering directly from the chest wall to the mammary gland and following it to reach the nipple-areolar complex. The duplicated lamella of the transverse fascia of the breast, which divides it in the upper and lower level and has an opening for vessels and nerves coming in from the chest wall, creates a similar mesentery to the small intestine mesentery in terms of its structure and build.

Conflic of interest: none declared

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Received: 11 May 2020
Accepted: 13 May 2020

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