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The surgical anatomy of the mammary gland. Vascularisation, innervation, lymphatic drainage, the structure of the axillary fossa (part 2.)

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Dynamically developing oncoplasty, i.e. the application of plastic surgery methods in oncological breast surgeries, requires excellent knowledge of mammary gland anatomy. This article presents the details of arterial blood supply and venous blood outflow as well as breast innervation with a special focus on the nipple-areolar complex, and the lymphatic system with lymphatic outflow routes. Additionally, it provides an extensive description of the axillary fossa anatomy.

Key words: anatomy of the mammary gland

The large-scale introduction of oncoplasty to everyday oncological surgery practice of partial mammary gland resections, partial or total breast reconstructions with the use of the patient's own tissue as well as an artificial material such as implants has significantly changed the paradigm of surgical procedures. A thorough knowledge of mammary gland anatomy has taken on a new meaning. Correct arterial blood supply to tissues is a key element in plastic surgery and breast reconstruction surgery.

Vascularisation of the mammary gland

Arterial vessels

The vascularisation of breasts is characterised by rather significant individual diversity. Its relatively stable elements are the internal thoracic artery (*arteria mammaria interna*) running through the system of perforators, the lateral thoracic artery (*arteria thoracica lateralis*), the thoracoacromial artery (*arteria thoracoacromialis*), end branches of the perforators of 3th–8th intercostal arteries (*aa. intercostales*) and little vessels supplying blood to the serratus anterior [1, 2].

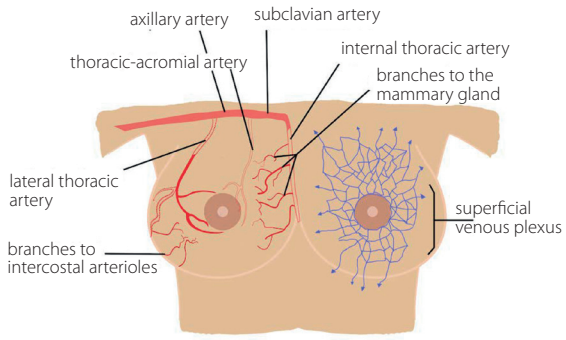

Figure 1. Arterial and venous vessels of the mammary gland

The internal thoracic artery (*arteria mammaria interna*) is a branch of the subclavian artery (*arteria subclavia*) which goes off it near the scalenus posterior (*musculus scalenus*) and enters the chest passing the subclavian vein (*vena subclavia*). Within the chest, it crosses with the phrenic nerve (*nervus*

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phrenicus) and continues its route on the internal surface of the front wall along the attachments of ribs to the sternum, 1–2 cm laterally to its edge, between the endothoracic fascia (*fascia endothoracica*) and the parietal lamina of the pleura. In each intercostal space, it divides itself into two branches:

1. the anterior cutaneous branch (*ramus cutaneus ventralis*),
2. the intercostal branch (*ramus intercostalis*) which connects directly to the appropriate intercostal artery (*arteria intercostalis*) through a direct branch of the aorta.

The arterial blood supply of the mammary gland is primarily ensured by medial thoracic branches (*rr. mammari mediales*) supplying medial and lower lateral quadrants. At the level of the 6th intercostal space, the internal thoracic artery is divided into two end branches: the musculophrenic artery and the superior epigastric artery.

The musculophrenic artery (*arteria musculophrenica*) is the final lateral branch of the internal thoracic artery with little branches going off to the 7^{th,} 8th and 9th intercostal spaces. Eventually, it divides itself and ends at the diaphragm and muscles of the lateral part of the abdomen [3, 4].

The superior epigastric artery (*arteria epigastrica superior*) is the final medial branch of the internal thoracic artery and its prolongation towards the rectus abdominis. Along its route, it branches off to muscles, the skin and the diaphragm. Its anonymous branches at the level of the xiphoid process of the sternum connect to the branches of the opposite side. The anonymous branches going off the right superior epigastric artery enter the falciform ligament of the liver and connect to the branches of the common hepatic artery. The superior epigastric artery within the rectus abdominis, at the level of the navel, connects to the inferior epigastric artery, a branch of the external iliac artery. The superior epigastric artery is the main artery supplying blood to the cutaneous--adipose flap of the hypogastrium used in TRAM flap breast reconstruction surgery.

The inferior epigastric artery (*arteria epigastrica inferior*) is a branch of the external iliac artery. It is used in breast reconstruction employing a DIEP flap with a vascular microfusion with the internal thoracic artery at the level of the 3rd rib [5, 6].

The axillary artery branches (*arateria axillaris*) supply the bones and muscles of the upper limb, pectoral muscles, the serratus anterior and the latissimus dorsi muscles, the shoulder joint and the mammary gland. The arteries forming the arterial network of the chest branch off from the axillary artery. These branches arise at different locations and because of their significant variety, they are hard to find during surgery.

The following arteries branch off from the upper section of the axillary artery:

- the superior thoracic artery (the highest) (*arteria thoracica superioris*),

the following arteries branch off from the middle section:

- **the thoracoacromial artery** (*arteria thoracoacromialis*),
- **the lateral thoracic artery** (*arateria thoracica lateralis*),

and the following arteries branch off from the lower section:

- the subscapular artery (*arteria subscapularis*),
- the anterior circumflex humeral vein (*arteria circumflexa humeri anterior*),
- the posterior circumflex humeral vein (*arteria circumflexa humeri posterior*).

The thoracoacromial artery (*arteria thoracoacromialis*) is a short stem going off on the anterior surface of the axillary artery over the upper edge of the smaller pectoral muscle. After crossing through the coracoclavicular fascia, it divides itself into four branches: thoracic, coracoid, clavian and branchial. The thoracic branch forms numerous connections with the internal thoracic artery, the lateral thoracic artery and intercostal arteries. In this way, it participates in supplying blood to the mammary gland, primarily the tail of Spence [7–9].

The lateral thoracic artery (*areteria thoracica lateralis*) goes off below the edge of the smaller pectoral muscle, runs downward and medially crossing with the ulnar nerve (*nervus ulnaris*) and the axillary vein (*vena axillaris*) at the front. Then, on the serratus anterior, it divides itself into 2th–5th intercostal spaces. Here, it gives off its lateral thoracic branches (*rami mammari laterales*), which cross through the greater pectoral muscle to supply blood to the mammary gland and the skin near it and then connect with the thoracic branches going off (as piercing branches) from the internal thoracic artery, which is the main breast-supplying artery [1, 3, 8].

Numerous connections of arterial vessels supplying blood to glandular tissue and covering the skin make three plexuses, which are the most important elements of arterial blood supply:

1. **The subdermal plexus** (*plexus subdermalis*) – very extended, formed by numerous anastomoses between the branches of the thoracobrachial artery and the neighbouring arteries: subclavian, subscapular and anterior branches of the perforators which come from the internal thoracic artery [10, 11].
2. **The preglandular plexus** (*plexus preglandularis*) – supplied by anterior and glandular branches of the lateral thoracic artery, the third perforator of the internal thoracic artery and other anterior thoracic perforators. Two major arteries, lateral and medial, form connections that circumvent the areola. Additionally, the preglandular plexus has numerous connections to the subcutaneous plexus. Together, they form an extensive network of arterial vessels covering the anterior surface of the gland and branching off, in large numbers, inside the gland, perpendicularly to the breast surface. These arterial branches penetrate the glandular tissue along the connective tissue septa surrounding lobules, lactiferous follicles and exosecreting ducts [10, 12].
3. **The retroglandular plexus** (*plexus retroglandularis*) – made by deep muscular perforators which are branches

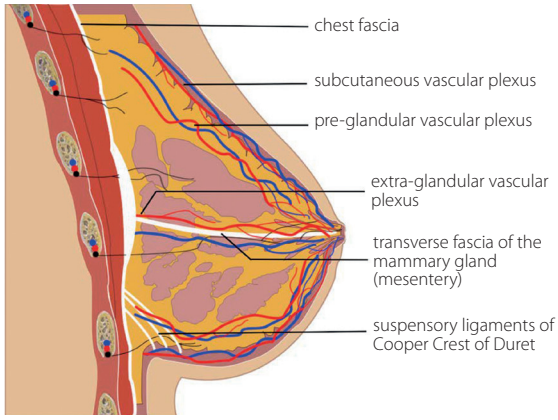

Figure 2. Sagittal cross section of the breast

of the thoracoacromial (coracoid) artery, deep branches of the medial (from the 2nd, 3rd, 4th and 5th intercostal artery) and lateral (from the 7th, 8th and 9th intercostal arteries) intercostal perforators. This plexus is of lesser functional importance, although it is closely related to the previous system of interglandular connections running along interlobar and interlobular connective tissue septa [13].

An important element of breast surgery is a thorough knowledge of the nipple-areolar complex vascularisation. Seitz et al. proposed the sources of blood supply to the areola and the nipple be divided into five anatomical spheres called *NACsomam* by the authors:

- I – medial,
- II – lateral,
- III – central,
- IV – inferior,
- V – superior.

In the studies performed, the majority of vascularisation was provided by inferior-medial sphere I. Moreover, it was confirmed that arterial blood supply to the nipple-areolar complex is symmetrical for both breasts in 96% of cases [14].

Venous outflow from the mammary gland

The main pathway for venous blood outflow is the axillary vein (*vena axillaris*). It is a short stem with a large lumen exceeding the diameter of the axillary artery, which is formed by the combination of two deep brachial veins and runs deep into the axillary fossa medially from its foundation to the lower edge of the clavicle. When it passes the clavicle, it transforms into the subclavian vein. The tributaries of the axillary vein are: the cephalic vein (*vena cephalica*), the lateral thoracic vein, the areolar venous plexus of the nipple (*plexus venosus alveolaris*), the thoracoepigastric vein and the intercostobrachial veins (*vv. intercostobrachiales*). An important anatomical element is the subareolar venous plexus, which forms a dense network of connections circumventing the areola (venous corona). From here, venous blood outflow may take two routes:

- superficial, which begins below the areola (Haller's plexus) and drains the blood to the internal thoracic vein and superficial veins of the lower part of the neck,
- deep, located at a greater depth under the superficial fascia, which transports blood to the internal thoracic vein, posterior intercostal veins and directly to the axillary vein [13, 15].

Breast innervation

Nerves providing innervation to the mammary gland come from the somatic peripheral nervous system and the autonomic sympathetic system. Within the breast, there are no parasympathetic system nerve endings. The innervation of the mammary gland tissue and the anterior-lateral area of the chest together with the covering skin is closely related. This is confirmed by the common ectodermal origin of both structures [16].

Breast innervation comes from three sources:

1. Ventral branches of spinal nerves, from Th2 to Th6 (intercostal nerves from 2nd to 6th). Cutaneous-glandular nerves are end branches of both lateral and medial perforators of intercostal nerves (*nn. intercostales*). After crossing through the pectoral muscles, the anterior medial branches of intercostal nerves 2nd–6th run on the breast surface providing innervation both to the mammary gland and the skin covering it. The branch running from the 4th intercostal nerve goes directly to the nipple [17, 18]. The group of lateral nerves is created by external branches of lateral perforators, from the 3rd to the 6th intercostal nerve, which enter the glandular tissue from the back, near the external borders. After branching off from the cutaneous branches, the main stems run upward along the posterior breast surface and regular glandular branches go off from them in the posterior-anterior direction. They run along the ligaments of Cooper and form an extensive network of connections innervating the areola skin. Numerous sensory endings, sensory bodies as well as pressure and temperature receptors make the nipple-areolar complex one of the best innervated areas of the female body [17, 19, 20].
2. Branches of the supra- and subclavian parts of the brachial plexus:
   - the medial thoracic nerve (C8–Th1, *nervus thoracicus medialis*) and the lateral thoracic nerve (C5–C7, *nervus thoracicus lateralis*) provide innervation to the greater and smaller pectoral muscles,
   - the long thoracic nerve (C5–C6, *nervus thoracicus longus*) provides innervation to the serratus anterior muscle,
   - the thoracodorsal nerve (C6–C8, *nervus thoracodorsalis*) provides innervation to the latissimus dorsi muscle [19, 21].
3. Supraclavicular nerves (C3–C4, *nn. supraclaviculares*) from the jugular plexus provide innervation to the upper part of the chest (near the clavicle).

PECS I and PECS II (*pectoral nerve blocks I & II*) are septum blocks within the chest wall commonly used as one of the elements of multimodal analgesia in breast surgery [13].

The branches of the autonomic system from the paravertebral sympathetic chain of superior thoracic ganglions form an important element of breast innervation. The motor fibres of the sympathetic system provide innervation to the smooth muscles of the areola and the nipple as well as the smooth muscles of the arterial vessels of the nipple-areolar complex.

The innervation of the nipple-areolar complex is extremely complex, because of frequent differences in the pathways of the nerves providing it. The most stable source of innervation comes from the lateral branch of the intercostal nerve. The innervation provided by the anterior branches of the 3rd, 4th and 5th intercostal nerves is characterised by greater diversity. The cutaneous branches of the 2nd and 6th intercostal nerves do not participate in the innervation of the nipple or the areola as they exclusively innervate the peripheral segments of the breast skin [13, 22].

Lateral cutaneous branches, of a greater diameter than the anterior branches, cross through the deep fascia along the medial axillary line and run in the medial direction on the pectoral muscle. At the level of the medial-clavicular line, they suddenly bend under the straight angle and run along the connective tissue septa of the breast towards the nipple, which they innervate in the form of numerous little branches. Only in rare cases do lateral branches run on the surface of the subcutaneous tissue directly to the nipple.

Anterior cutaneous branches innervate the medial part of the nipple-areolar complex. They cross through the fascia along the parasternal line (*linea parasternalis*) and divide into medial branches running to the tissue covering the sternum while the lateral branches in the subcutaneous tissue go on the surface to the direction of the nipple. These branches reach the edge of the areola of the left breast within the area between 8 and 11 o'clock and the right breast – between 1 and 4 o'clock. Therefore, peri-areolar incisions should be avoided in these areas because of the risk of damage to the main branches innervating the nipple. This may be the cause of a partial or complete loss of sensation [8, 17, 21].

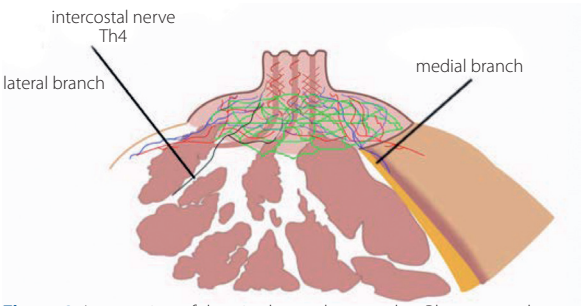

Figure 3. Innervation of the nipple-areolar complex. Please note that the lateral and medial branches of the intercostal nerve 4 run along a different route

There is an interesting relationship between the diameter and number of nerve branches providing innervation to the areola and the nipple – the smaller the diameter, the more numerous the branches [17].

Lymphatic drainage

The anatomical foundations of lymphatic drainage were presented in 1874 by Sappey, who suggested that the lymph from the mammary gland is drained separately from other parts of the trunk. Until today, knowledge with regard to this subject is derived from the works by Sappey, Poirier and Cuneo [23].

The understanding of the interstitial fluid circulation in the breast makes it possible to better realise the significance of correct surgical incisions and the rules for soft tissue movement during oncoplasty. The routes of lymph drainage from the mammary gland allow better planning and performance of such surgeries in patients with breast cancer.

Routes of lymphatic outflow

Lymph vessels make a network of open vessels draining the interstitial fluid from all areas of the human body. Having a small diameter initially, they connect to form increasingly greater vessels, in a similar way to the venous system. On the way, they pass through lymph node stations, which serve as filters and a form of the body's defence against microorganisms and tumour cells. Eventually, the lymph flowing through the thoracic duct (*ductus thoracicus*) and the right thoracic duct reaches, respectively, the left and right venous angle at the junction of the subclavian vein and the internal jugular vein, where it flows into the venous system.

The lymphatic drainage of the breast starts in the intercellular spaces of glandular tissue lobules through a network of non-valvular lymph capillaries (20–70 µm in diameter). Over the network of pre-collectors (70–150 µm in diameter), which already have valves and are located in the dermis, the lymph flows to deep lymph collecting vessels located in deep tissues underneath the deep fascia. A network of many lymph vessels located just under the breast areola is created by the superficial and deep sub-areolar plexus called, after its discoverer, the Sappey plexus [23, 24].

Due to the ectodermal origin of breasts, the lymphatic draining of the mammary gland is closely related to the skin drainage. Lymph from the skin is drained through an extended network of lymph vessels running to the subcutaneous plexus located between the skin and the superficial fascia. In a similar way, lymph from the mammary gland is drained through extended lymph plexuses around each lobe flowing to the superficial main collector and creating the sub-areolar Sappey plexus, which, in turn, connects to the deep fascia plexus through numerous vessels crossing the glandular tissue.

Thus, the network of breast lymph vessels is made of four connected plexuses:

- the cutaneous plexus (*plexus cutaneus*),
- the subcutaneous plexus (*plexus subcutaneus*),
- the fascial plexus of the greater pectoral muscle (*plexus fascialis*),
- the glandular plexus (*plexus glandularis*), which includes lobules, lobes and lactiferous ducts [24, 25].

The glandular plexus drains lymph directly to the subcutaneous plexus located under the areola called the Sappey plexus. The fascial plexus is also connected to the subcutaneous plexus through the vessels running in interlobular septa made of connective tissue. Subareolar plexuses drain lymph in two directions: to axillary lymph nodes and to the lymph nodes located along the internal thoracic artery. Moreover, there are lymphatic connections between both breasts, which may be the cause of rare metastases to the lymph nodes of the opposite side. The drainage from the fascial plexus does not have a significant share in the lymphatic drainage of the breast, but it may be an alternative route if the main drainage pathway is closed. Lymph in the fascial plexus comes from the drainage of the greater and smaller pectoral muscles and, from there it flows to the apical axillary nodes. The intermuscular lymphatic route along the thoracoacromial artery, also known as Groszman's route, goes through 1–4 Rotter's nodes located between the greater pectoral muscle and the smaller pectoral muscle.

Because of the very extensive network of lymph vessels and numerous connections between lymph nodes, each breast may be drained both to the lateral axillary nodes and medial retrosternal nodes. However, most of the lymph from the breasts is drained to axillary lymph nodes [3, 24].

Lymphatic drainage may also be achieved through vessels accompanying lateral branches of intercostal arteries to nodes located just behind the ribs and, from there, directly to the thoracic duct (*ductus thoracicus*). Another possible direction of lymphatic drainage is to the antephrenic node, the liver and then to the ventral nodes (Gerota's pathway) [13, 24].

From the superficial (subareolar) and deep plexuses, the lymph is further drained along three main pathways:

1. **the axillary or lateral pathway** which drains the lymph directly from the subareolar plexus, satellite lymph nodes and most parenchymal lymph vessels. Lymphatic drainage occurs along the lower edge of the greater pectoral muscle going to the group of axillary lymph nodes,
2. **along the internal thoracic artery**, where drainage starts both in the medial and lateral part of the breast and lymph vessels go through the greater pectoral muscle inside the chest wall. Along the medial edge of the breast there are pathways combining the areas of lymphatic drainage from both breasts and going to parasternal lymph nodes [3],
3. the **retromammary pathway** (*retromammary pathway*) – lymphatic drainage from the posterior part of glandular tissue [13].

Lymph nodes

Axillary lymph nodes are the main station filtering the lymph from the mammary gland, although they are located outside the gland. Additionally, they are also a part of the lymph flow pathway from the upper limb and the chest wall.

Axillary lymph nodes can be divided into 5 groups:

1. Lateral thoracic nodes (or thoracic-axillary) usually make a group of 5–10 lymph nodes located along the lateral thoracic vessels directly behind the greater pectoral muscle, below the smaller pectoral muscle.
2. Acromial nodes (lateral axillary) are a group of 1–6 nodes located along the posterior surface, outside the axillary vein and the lower edge of the smaller pectoral muscle. They drain the upper limb. They should be preserved during surgical lymphadenectomy because their removal causes lymphatic oedema of the upper limb. The boundary of correct lymphadenectomy is the lower edge of the axillary vain.
3. Subscapular nodes (lower scapular) are a group of about 5 lymph nodes located along the nerves and vessels running to the latissimus dorsi muscle. They drain the lateral part of the back but should be removed during lymphadenectomy because of numerous connections with lymph pathways draining the lower-lateral parts of the mammary gland.
4. Central axillary nodes are 2–6 nodes occupying the central part of the axillary fossa which are located below the smaller pectoral muscle and partially behind it. They drain lymph from

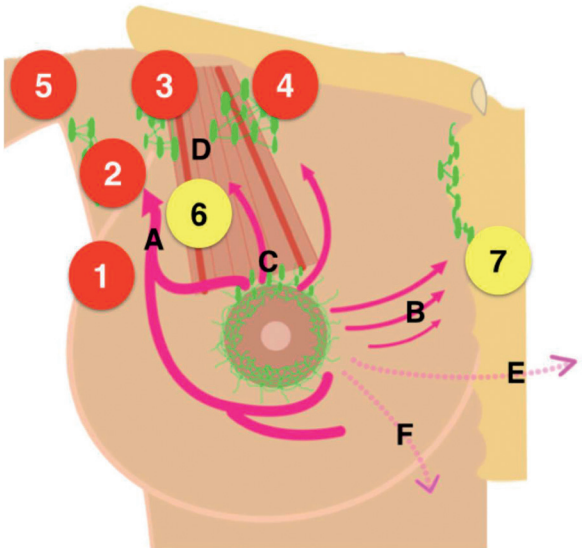

Figure 4. Lymphatic drainage of the mammary gland
Lymph nodes: 1 – lateral thoracic nodes (5–10), 2 – subscapular nodes (5), 3 – central nodes (2–6), 4 – subclavian nodes – apical (10), acromial nodes (1–6), 6 –Rotter's nodes (1–4), 7 – retrosternal nodes
Routes of lymphatic outflow from the mammary gland: A – axillary route (lateral), B – peristernal route (medial), C – extra-glandular route, D – Groszmann's route, E – route to the opposite breast, F – route along epigastric and subhepatic plexuses of the sac of the rectus muscle of the abdomen

the three previous lymph node groups. In the original method of mastectomy including lymphadenectomy described by Patey, the cutting of the attachment of the smaller pectoral muscle enabled easier access to this group of lymph nodes.

5. Subclavian nodes (apical axillary) are 10–11 lymph nodes located at the top boundary of the smaller pectoral muscle.

Rotter's interpectoral lymph nodes (1–4) are located between the greater and smaller pectoral muscle. They collect the lymph from the upper quadrants and the central part of the breasts. From these nodes, the lymph flows directly to the lymph nodes located outside or above the smaller pectoral muscle [3, 13, 24–26].

The parasternal lymph nodes (internal pectoral) are located along internal thoracic vessels within the chest. They can be found at the level of sternal attachments, from the 1st to the 6th rib. Lymph flows to them from the medial quadrants of the breasts, in particular at the level of the 2nd, 3rd and 4th intercostal spaces. These nodes, because of their location inside the chest, cannot be examined as part of a routine clinical examination and scintigraphy is necessary.

For the needs of surgical anatomy, the axillary lymph nodes are divided into 3 levels as proposed by Berg in 1955:

- The first level of lymph nodes contains 9–24 nodes located laterally from the mammary gland and medially from the lateral edge of the *latissimus dorsi*. The boundary is the lateral edge of the smaller pectoral muscle. This group contains lateral thoracic nodes, subscapular nodes, acromial nodes and central axillary nodes.
- The second level of lymph nodes contains 2–7 nodes located behind the greater pectoral muscle between its lateral and medial edge. This group contains superior axillary nodes and intermuscular lymph nodes.
- The third level of lymph nodes contains 1–12 lymph nodes located above the medial edge of the greater pectoral muscle. This group contains subclavian nodes.

Most (80–90%) lymphatic drainage from the breasts is achieved through the first level of axillary lymph nodes. In 4–20% of cases, the route of the lymphatic flow may pass over the first level and go directly to superior axillary nodes and intermuscular nodes, i.e. to the second level. Only in 3–5% of cases may lymph flow directly to the 3rd level of axillary lymph nodes with the passing over of the two lower levels. This is why the correct location of the sentinel node during oncological breast surgeries is so important in practice [26, 27].

About 75% of lymph flows along collective lymph vessels from the mammary glands through the peri-areolar plexus to the side in the direction of axillary lymph nodes. The remaining part goes directly to the lymph nodes located within the chest along the internal thoracic artery, to the opposite breast and to the superficial plexus of the rectus abdominis. Some of the lymph from the upper quadrants of the breasts may go directly to the lymph nodes located between the pectoral muscles (Rotter's route) [27].

Axillary fossa

The axillary fossa (*fossa axillaris*) is an important element in breast surgery. It is located below the acromial joint, which is the main connection between the chest wall and the upper limb, between two axillary folds, the anterior and the posterior. In its anatomical position, the axillary fossa is a narrow space, which, when an arm is abducted, forms a three-dimensional area looking like a pyramid with a cut-off peak in the cranial direction. In this place, under the clavicle, such important anatomical structures as arterial vessels, veins, nerves and lymph vessels enter the axillary fossa [18, 28].

Boundaries of the axillary fossa

The boundaries of the axillary fossa are made of 4 walls:

1. The narrow lateral boundary created by the intertubercular sulcus (*sulcus intertubercularis*) located between the major tuberculum (*tuberculum majus*) and the minor tuberculum (*tuberculum minus*) of the humerus.
2. The medial boundary made of the serratus anterior muscle (*musculus serratus anterior*), ribs and intercostal muscles (*mm. intercostales*).
3. The anterior boundary limited by the pectoral major (*musculus pectoralis major*), the pectoralis minor (*musculus pectoralis minor*) and the subclavian muscle (*musculus subclavicularis*).

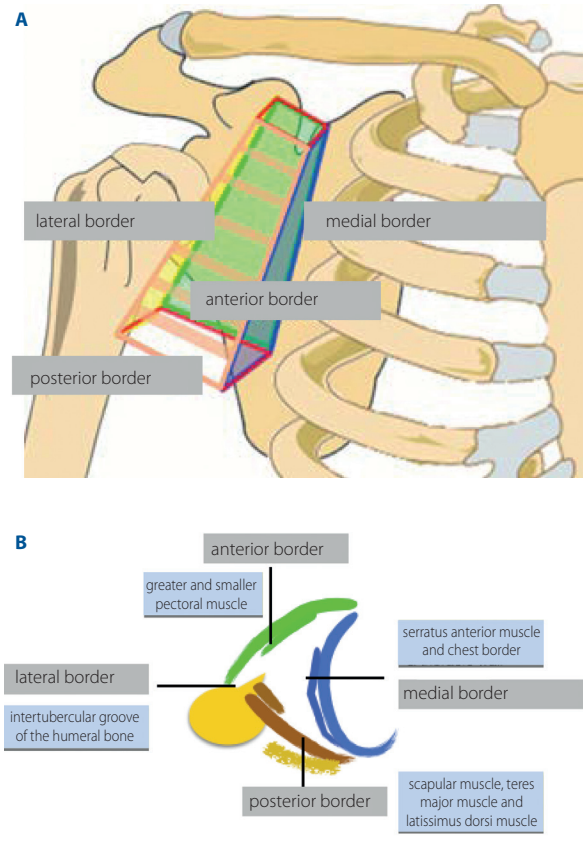

Figure 5. Anatomical borders of the axillary fossa: A. frontal view, B. transverse view

4. The posterior boundary between the subscapular muscle (*musculus subscapularis*), the latissimus dorsi muscle (*musculus latissimus dorsi*) and the teres major muscle (*musculus teres major*) [28, 29].

The apex, which is an inlet for clinically important structures running through the axillary fossa, is limited by the lateral edge of the 1st rib, the top edge of the scapula and the posterior edge of the clavicle.

The foundation of the axillary fossa is the superficial axillary fascia (*fascia axillaris superficialis*), which becomes the superficial pectoral fascia (*fascia pectoralis superficialis*) near the inframammary fold, the thoracic fascia (*fascia thoracica anterolateralis*) on the lateral side of the trunk and the superficial dorsal fascia (*fascia superfitialis dorsi*) near the posterior axillary fold [30–32].

The axillary fossa can be divided into three separate spaces: the subpectoral space (*spatium subpectorale*), the subfascial axillary space (*spatium axillare subfasciale*) and the space for the neurovascular bundle. The very narrow subpectoral space is located between the perimysium and the deep fascia of the pectoral muscle, from the clavicle to the anterior axillary fold. It is especially visible when lymph collects there after the removal of the axillary fossa lymph nodes. The interpectoral space limited by the superficial and deep axillary fascia is much more important in practice. This is where intercostobrachial nerves (*nn. intercostobrachiales*), the basilic vein (*vena basilica*) and deep axillary lymph nodes (*nodi lymphatici axillares profundi*) are located. The precise preparation of lymph nodes in this space enables their removal together with the surrounding adipose tissue without jeopardising the main neurovascular bundle and risking damage to it. [31].

Contents of the axillary fossa

The axillary fossa is built of the following structures:

1. the axillary artery (*arteria axillaris*) – the main artery supplying blood to the upper limb. Its medial and posterior parts cross the axillary fossa,
2. the axillary vein (*vena axillaris*) – the basic vein draining blood from the upper limb. Its tributaries within the axilla are the cephalic vein (*vena cephallica*) and the basilic vein (the royal vein, *vena basilica*),
3. the brachial plexus (*plexus brachialis*) made of spinal nerves C5–Th1. The main nerves going off from this plexus supply the upper limb, the chest wall and the breast,
4. axillary lymph nodes (*nodi lymphatici axillares*) – draining nodes for the lymph flowing from the upper limb, the chest wall and the mammary gland,
5. the biceps branchii muscle (*musculus biceps brachii*) and the coracobrachialis muscle (*musculus coraco-brachialis*). The tendons of these muscles run through the axillary fossa and attach to the coracoid process (*processus coracoideus*) of the scapula [29].

Conflict of interest: none declared

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