



Axillary Arch: Disorientating the Axilla!

Eleni I Effraimidou*

Department of Surgery, Faculty of Medicine, Democritus University of Thrace, University Hospital of Alexandroupolis, Greece

Editorial

Axilla is an anatomical region with a complex anatomy, containing the neurovascular bundle to the upper limb and its co-laterals, several critical nerves, arteries and muscles, and lymphatics. Furthermore, due to connection with the breast, axilla is the common route for metastatic involvement from breast cancer. As a result, in cases of breast cancer, the absence or presence of cancer cells in axillary lymph nodes is the most powerful prognostic indicator for the disease. The increasing surgical importance of the axilla region during any axillary surgery has stimulated the interest for the anatomical variations of the axilla, which have been described in textbooks of human anatomy and in those of operative surgery [1,2]. Review of the anatomical and surgical literature revealed that there are three supernumerary muscles, namely the axillary arch, the pectoralis quartus and the chondroepitrochlearis muscles, as well as the aplasia of the lower part of the pectoralis major muscle. The frequency of all these anomalous muscular variations is higher in cadaveric dissections than the one reported during surgery [3]. This lower frequency is probably due to the fact that even experienced surgeons are not familiar with the existence of AA and the other anomalous muscles. The other fact, explaining the difference in frequency, is that during surgery the region is not dissected thoroughly, as it happens in anatomical dissections. A surgeon may encounter these muscular variations when performing regional surgical procedures, such as axillary dissection and lymphadenectomy for breast cancer, lymph node biopsy, reconstruction techniques and axillary bypass operations [3,4]. Axillary Arch (AA), is the most important of these variations, and has been reported to cause difficulty during Axillary Lymphadenectomy (AL) or Lymph Node Biopsy (LNB), and also it may compress the neurovascular bundle [1,5-9].

Anatomical and Surgical Literature Review

The Axillary Arch (AA) or Langer's axillary arch or axillopectoral muscle or pectodorsal muscle, was first described by Ramsay in 1795 and then confirmed by Langer in 1864. This supernumerary muscle is reported to have an incidence of 0.25% to 43.8% in the literature, while the reported percentage during surgery has been found to be 0.25% to 6.52% [1,3]. The typical AA extends from the anterior border of the latissimus dorsi muscle to the posterior layer of the pectoralis major tendon, crossing the axilla in a relatively high frequency of 7% to 8% of population [3]. Moreover, this muscular arch shows great variability and it is described in the literature to have multiple insertions into anywhere along a line extending from the pectoralis major insertion to the coracoid process. Multiple axillary arches, as well as, a single axillary arch with multiple insertions have also been reported.

Clinical and Surgical Implications

Axillary dissection is a surgical procedure that incises the armpit (axilla) to identify, examine and remove axillary lymph nodes. Axillary dissection is utilized to stage breast cancer (axillary lymphadenectomy -AL, axillary nodes sampling -ANS, axillary sentinel node biopsy -SLNB), in order to determine the necessity of further treatment [7-9].

Additionally, AL is indicated for treating persons diagnosed with operable breast cancer, who are undergoing any type of mastectomy. During the surgical approach of the axilla, the boundaries of the surgical field form a triangle with the serratus anterior muscle at its base and the medial surface of the humerus, where the pectoralis major and the latissimus dorsi muscles meet, at its apex. The anatomical structures within the axillary region are expected to appear during AL [3,7-9]. Most AL includes lymph nodes from Level I and II (lateral and posterior to the pectoralis minor muscle) [3,4,7-9]. In order to remove these nodes with minimal morbidity, the surgeon will have to identify several structures, which are:

- The lateral border of the pectoralis minor and major muscles

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*Correspondence:

Eleni I Effraimidou, Department of Surgery, Faculty of Medicine, Democritus University of Thrace, University Hospital of Alexandroupolis, Greece, Tel: 00302551351330; Fax: 00302551030372; E-mail: eeffraem@med.duth.gr

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- The latissimus dorci muscle
- The axillary vein
- The long thoracic nerve
- The thoraco-dorsal nerve
- The intercostal brachial nerves
- The lateral pectoral nerve.

Two important structures must be identified and preserved: the long thoracic nerve (or Bell's nerve), which runs craniocaudally on the medial wall over the serratus anterior, and the neurovascular bundle to the latissimus dorci, which runs craniocaudally on the posterior wall over the latissimus dorci [7-9]. This vascular bundle is particularly important as it is the pedicle on which we base our latissimus dorci myocutaneous flap (LD flap) during LD-breast reconstruction technique [9]. Clinically not all of muscular anomalies are important for axillary surgery, especially for AL. From the topographical point of view, only the muscular bands that pass through the axilla or change the boundaries of the surgical field may affect axillary dissection. As it is discussed above there are three anomalous muscles that may affect axillary dissection. In the literature there are only few reports analyzing the complications that may arise from each of these muscular anomalies, whereas most of them are referring to the implications arising from AA. AA can occasionally be palpable and it can be confused with enlarged lymph nodes or soft tissue tumors. This muscular arch may cause intermittent compression of the axillary vein and may lead to axillary venous thrombosis or it may present clinically as a finding of fullness within the axilla. It has also been reported to cause lymphatic compression with venous thrombosis or lymphedema, or thoracic outlet obstruction and shoulder instability syndrome. However, AA is usually asymptomatic and its main importance is the problem it can cause during AL for breast cancer. The presence of AA may limit access to the lower lateral group of Level I axillary lymph nodes, thus resulting in an incomplete axillary clearance. This obviously has serious implications for local recurrence. Moreover, AA could be misregarded as the lateral border of the AL -which normally is the anterior margin of the latissimus dorci muscle- resulting to lead the surgeon one level above the axillary vein with the associated risk of injuring the neurovascular bundle of the axilla. Persistence of the AA after AL increases the risk of upper limb lymphedema due to compression of the axillary vein and the lateral lymphatic trunks. In cases of local recurrence due to inadequate axillary clearance, the management becomes difficult and the risk for local morbidity and lymphedema increases. Since these complications are significant, researchers conclude that AA should be identified and divided to allow adequate exposure of axillary lymph nodes in order to achieve an uncomplicated, safe and complete lymphatic dissection. Furthermore, the identification

of AA is important during SLNB, because of the need to adequate exposure and good haemostasis during the procedure. Although axillary dissection for breast cancer is the most common type of axillary surgery there are other surgical procedures in the armpit area which may be affected by the presence of AA, such as bypass surgeries using axillary vessels. Additionally, ischaemic necrosis can complicate LD-flap breast reconstruction if the AA stretches or compresses the thoracodorsal pedicle. Therefore, all breast and/or oncologic surgeons operating in the axilla region should be aware and able to recognize axillary arch and its musculotendinous variations, in order to determine a safe approach to the armpit. On the other hand, the other rare muscles and tendonous arches, which either pass through the axilla or change the boundaries of the AL surgical field, may occasionally cause complications during AL. However, there are no studies reporting intraoperative recognition of atypical pectoralis quartus, chondroepitrochlearis and aplasia of the lower part of pectoralis major muscles, and as a result their significance in axillary surgery is not known. Nevertheless, preoperative diagnosis of these anomalous muscles is difficult and apart from the AA, which should be recognized during axillary dissection, the intraoperative recognition of the other three muscular variations seems to be useful.

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