

COMMENTARY

MINIMIZING SECONDARY ARM LYMPHEDEMA FROM AXILLARY DISSECTION

ABSTRACT

Regional complications after axillary lymphadenectomy are common and usually involve perioperative skin dehiscence, wound infection, and seroma formation and later arm lymphedema. Gentle handling of tissues during operation, and routine use of closed catheter suction drainage with direct external axillary compression with immobilization of the shoulder after nodal dissection are advocated to minimize both the early and late sequelae. Healing by primary intent is facilitated and the opportunity for reconnection of divided lymphatics (lymphangiogenesis and lymphvasculogenesis) are thereby optimized.

Extensive axillary lymph nodal dissection reduces the transport capacity of lymphatics thereby promoting secondary arm lymphedema. Perhaps the most common question asked by a woman with arm lymphedema after treatment for breast cancer is "Why me with a swollen arm?" Halsted in 1921 coined the expression "elephantiasis chirurgica" (1), in describing secondary arm lymphedema after breast amputation and axillary lymphadenectomy. In that seminal paper, Halsted recognized that less radical axillary dissection was associated with diminished occurrence of later arm lymphedema without higher incidence of axillary tumor recurrence. Moreover, he also emphasized that perioperative complications of axillary dissection, namely, wound dehiscence, infection and seroma are accompanied by more frequent and more severe arm lymphedema.

*Lymphatic Axillary Anatomy (2-9)**Arm lymphatics*

The extremities have both a superficial and a deep lymphatic vascular network (Fig. 1). Lymphatics of the upper arm consist of both a medial and lateral component. In the medial upper arm, lymph flows from superficial to deep collectors towards the axilla and its lymph nodes. The deep lymphatic collectors of the upper arm ascend paralleling the brachial and axillary arteries (termed "tractus brachialis"). The lateral, upper arm lymphatic pathways predominantly terminate in the lymph nodes of the most superior portion of the axilla (4,9). With axillary lymphatic blockage, lymphatic connections develop between the superficial and deep lymphatic systems and function to restore the lymphatic transport capacity. This compensatory mechanism occurs over time (sometimes referred to as the "latent" phase of secondary lymphedema). As Halsted recognized in describing the quantitative aspects of lymph drainage—the more radical the axillary dissection including the skeletonization (cleaning) of the axillary vessels, the more frequent the occurrence of secondary arm lymphedema. Whereas lymphatics that parallel the axillary artery are part of the lymphatic pathways that drain the arm, in my experience they rarely, if ever, are involved with metastases from cancer of the breast or ipsilateral axilla.

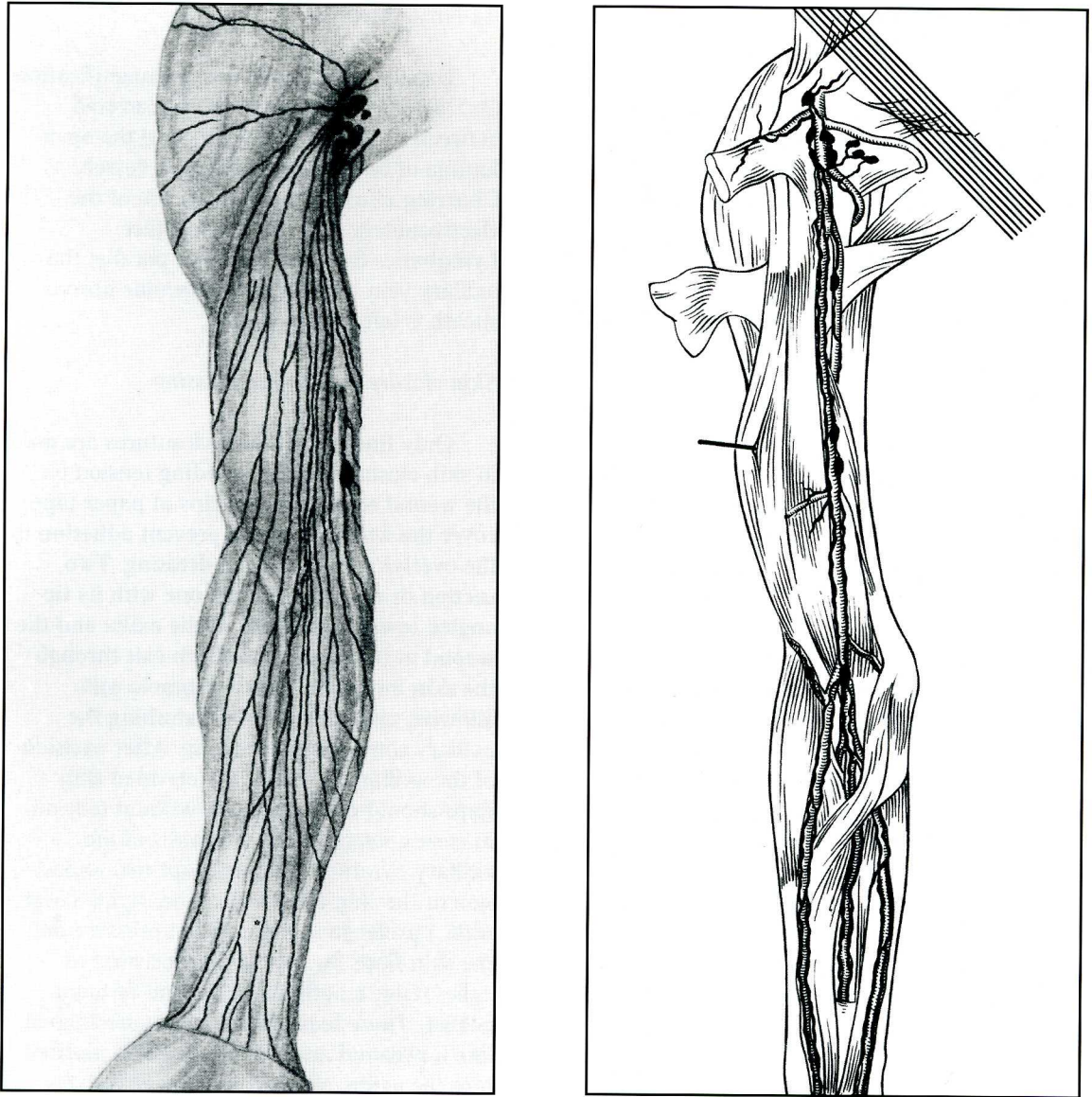


Fig. 1. Superficial (left) and deep (right) lymphatics of the upper extremity.

Lymphatics of the breast and axilla

Lymphatic drainage of most of the anterior chest wall, including the breast, is towards the axilla. It is important to emphasize that the lymphatic pathways of this region and the upper extremity do not feed a specific axillary lymph node.

Bidirectional communications connect with several different lymph nodal sites in the axilla (4). This functional "lymphatic traffic circle" is termed "axillary lymphatic plexus." Morphologically, axillary lymph nodes are subdivided into lateral, central axilla, upper and lower pectoral and infraclavicular groups.

In the axilla, there are several anatomical variants of lymph flow (9):

- a) Medial lymph collectors of the arm are superficial within the epifascial compartment. Accordingly, it is undesirable to carry an incision on the chest across the axilla on to the arm.
- b) Both medial and lateral collectors either directly or indirectly reach the subfascial axillary nodes where they are susceptible to excision.
- c) Some (12%) of lymph collectors bypass the axilla to drain adjacent to the cephalic vein (the deltoid or lateral lymphatic bundle) as described by Kubik (4) in more than 100 non-operated/non-radiated axillary dissections.
- d) The number of lymph collectors draining to the axilla varies between one and ten. The more the lymph collectors, the higher the chance after axillary dissection that some will be preserved and the greater the possibility of lymphatic-lymphatic connections being reestablished.

Do's and Don'ts in Axillary Nodal Dissection

The clinical goal is to completely remove lymph nodal metastases (usually originating from the breast) without causing later arm lymphedema.

Skin incision

One should avoid crossing the axilla towards the upper arm with the attendant possibility of severing the lateral lymph collectors paralleling the cephalic vein. For an isolated axillary dissection, I prefer a "Z" plasty with thick skin flaps. This technique prevents overly aggressive retraction of skin edges and provides excellent exposure of the base of the axillary pyramid, thereby minimizing tissue trauma.

Axillary dissection

Usually using assistance of magnification (3x), all tissues to be divided are severed between ligatures. Suture ties seal the open lumina of both blood and lymph vessels. Charring of axillary tissues by use of the electrocautery is avoided altogether. Lymphatics from the arm that parallel the axillary vein with its neurovascular fibrous sheath is left entirely intact.

Skin closure and wound dressing

Only fine intracutaneous sutures are used in skin closure thereby avoiding tension on the wound edges. Small strips of paper tape cover the wound edges to prevent adhesion to the overlying compression dressing. Two suction drains are inserted; one with its tip angled towards the apex of the axilla and the second at its lateral base. Both exit through the skin low at the lateral thoracic wall allowing removal without disturbing the axillary compression dressing. After excision of the axillary contents, the elevated skin flaps should reapproximate without tension in close contact to the side walls of the axillary pyramid. To obtain optimal apposition of the skin flaps to the underlying chest wall, I prefer to apply uniform pressure on the skin flaps by a dressing consisting of cubes (edge length about 2-3 cm) of foam rubber. These foam rubber cubes are shaped like a pyramid and when externally inserted into the axilla, all dead space is effectively obliterated.

Compression is maintained for approximately 7 days. In addition, the axillary wound site is immobilized by a modified Desault bandage (similar to a sling and swathe) which leaves the elbow, wrist and hand joints free to move. The bandage also serves as a reminder for the patient not to attempt to move the shoulder and thereby disturb axillary wound healing. If the patient experiences pain with this dressing, it must be checked promptly by the operating surgeon.

As Haagensen has written, "I dress my wounds myself. Even with patients, for whom I act as first assistant while my resident surgeon operates, I supervise the post operative care of the wound" (10). It is equally important to explain to the patient the reasons for the post-operative dressing, if necessary repeatedly, to encourage tolerance of its inconvenience.

Suction drains

When to discontinue suction on the axillary catheters is a matter of experience and depends on the chief surgeon. In the first few days after operation, I personally check the dressing and suction tubes twice a day. Discontinuance of closed catheter drainage is not strictly dependent on the specific postoperative day (11-14), nor does it depend on the amount of lymph fluid removed (15-20). I prefer to remove the tubes when without suction there no longer is lymph drainage. A recent paper suggests that application of a fibrin sealant to the raw surface of the axillary wound prior to skin closure can dramatically reduce the quantity and duration of serosanguineous lymph drainage (21). One day after the suction drains are removed, the modified Desault bandage is also discontinued and the patient is fitted with a simple arm sling.

Shoulder immobilization

A non-injured joint articulation with its capsule intact may be immobilized without compromise of joint motion. For example, knee motion after application of a long leg cast for an ankle fracture for as long as 12 weeks does not permanently impair genuflexion nor mobility of the joints of the foot. Similarly, I have not observed a "frozen" shoulder as long as one month after immobilizing this joint as described after axillary dissection. The reason for regional immobilization is to facilitate uncomplicated axillary wound healing (16,20). After 6-9 days

usually, the Desault bandage typically is discontinued with continuance of an arm sling. The patient is reminded to only gradually move the shoulder no more than axillary pain or discomfort permits.

Wound complications and later development of arm lymphedema

Gregl (17) followed 1155 patients after mastectomy with axillary dissection for more than 3 years. Seventy-eight percent developed secondary arm lymphedema. Primary healing of the axillary operative site, however, had occurred in only 22%. Jeffrey et al (22) found using ultrasonography that 92% of 81 patients undergoing axillary nodal dissection had retained fluid in the axilla and that 42% of these required aspiration of the axilla for "seroma."

Careful axillary lymphadenectomy and perioperative wound care using foam rubber axillary compression and shoulder immobilization has dual advantages. First, it eliminates unpleasant and costly local complications and, secondly, minimizes later development of secondary arm lymphedema. Leakage from lymphatic vessels (they do not hemorrhage!) is circumvented by use of ligatures. In conjunction with compression of the chest wall and axilla augmented by closed suction drainage, all dead space with its potential for lymph sequestration is obliterated.

Using atraumatic "surgical" technique (not an oxymoron), tissues are minimally injured and resprouting of lymphatics is facilitated (23) allowing for new lymphatic-lymphatic reconnections. Such lymphangiogenesis and lymphvasculogenesis improves the lymphatic transport capacity. Along with optimal wound healing, avoidance of a lymph fistula, light manual massage and local growth factors such as vascular endothelial growth factor (VEGF) and angiopoietin, each works towards restoration of lymph flow. Moreover, external compression and regional immobilization limits the formation of scar tissue which detrimentally acts to impede

restoration of lymphatic drainage (24). These maneuvers also limit the development of fibrosis of the walls of the lymphatic vessels themselves.

The Future

It is hoped that the recent popularity of skin-sparing mastectomy and selected sentinel node biopsy which limits interruption of chest wall lymphatics and the extent of axillary dissection will prove equally effective to more standard radical operations in eradicating breast cancer while minimizing the risk of later arm secondary lymphedema. It is also anticipated with emerging knowledge regarding the human genome and modern tools of molecular medicine that treatment of breast cancer and other malignancies will someday move away from the surgical arena, that axillary staging will no longer be necessary, and that secondary arm lymphedema as a sequela of cancer treatment will be rendered of historical interest only.

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