Abstract  Background: Along with the ongoing modifications in treatment of primary breast cancer, the purpose and extent of lymph-node dissection has changed. The following is an overview of the current knowledge and practice of lymph-node dissection in breast cancer, with special regard to expected developments in the near future. Axillary dissection is described as a ten-step procedure, including dissection of level-I and -II and Rotter’s nodes, without level-III nodes, providing at least ten lymph nodes for accurate staging information.

Discussion: Axillary dissection still offers the most efficient local control in node-positive patients, whereas, in primarily node-negative patients, irradiation seems to be equally effective. In general, lymph-node dissection does not alter overall survival but there is no doubt that surgical therapy still contributes to cure in early-breast-cancer patients and seems to be curative for certain patients with stage-I carcinoma. The lymph node status of the axilla is crucial for the indication of adjuvant therapy in early invasive breast cancer, but an increasing number of clinical node-negative patients could be managed with information based on features of the primary tumor, regardless of the nodal status. The most promising new concept for the selection of node-positive patients, while avoiding unnecessary morbidity of axillary dissection in early-breast-cancer patients, is the sentinel-node concept. The principle is based on the identification of the first “sentinel” lymph node reached by lymphatic flow. Thus, only proven node-positive patients undergo axillary dissection. Local failure of internal mammary lymph nodes is rarely recognized; however, internal mammary lymph nodes seem to have an underestimated prognostic significance in about 10–20% of axillary node-negative patients. This may lead to the withholding of systemic therapy for patients with early breast cancer. Nevertheless, there is no indication for a routine parasternal dissection today. The sentinel-node concept may also support the selection of diagnostic internal lymph-node biopsy and subsequent adjuvant therapy in cases with no axillary lymph-node metastases but with internal lymph-node metastases.

Key words  Breast cancer · Lymph-node dissection · Lymph-node status · Lymphonodectomy · Sentinel-node biopsy
**Introduction**

The treatment of breast cancer has been one of the major clinical and surgical problems ever since the beginning of medicine. Hippocrates stated, in 400 BC, that “it is better not to apply any treatment”, whereas Galen (129–200 AD) tried to excise tumors by “accurate incisions surrounding the whole tumor, so as not to leave a single root.” From that time until now, the main part of breast-cancer therapy has been surgical. In addition to the removal of the tumor, the intention and extent of lymph-node dissection has changed, along with the understanding of the disease. In this article, we give an overview of the current knowledge of the disease and the surgical therapy.

**Technique of axillary lymph-node dissection**

Axillary dissection means a stepwise exposition and preservation of the anatomic “guideline structures” and an en bloc dissection of the lymphatic tissue according to different levels. The sequence of the surgical steps are not generally standardized, and several different techniques have been described, essentially guided, however, by the following anatomic structures [1, 2, 3].

The anatomic structures of the axilla which must be exposed in order to function as guidelines of dissection are: the lateral border of the major pectoral muscle, the minor pectoral muscle, the anterior border of the latissimus dorsi, the axillary vein (inferior border), the long thoracic (Bell’s) nerve and the thoracodorsal nerve and vessels. According to Berg and the Union Internationale Contra la Cancrum convention [2], the axilla is divided into three levels:

- **Level I (low axilla).** Lymphatic tissue lateral to the lateral border of the pectoralis minor muscle and inferior to the axillary vein
- **Level II (mid-axilla).** Lymphatic tissue between the medial and lateral borders of the pectoralis muscle and the interpectoral (Rotter’s) lymph nodes
- **Level III (apical axilla).** Lymphatic tissue medial to the medial margin of the pectoralis minor muscle, including those designated as subclavicular, infraclavicular or apical nodes

When performing an axillary dissection of level I and II through the incision of the tumor resection, the following steps are important:

1. Placement of the patient supine on the operating table, with his/her arm outstretched 90° on a sideboard.
2. Identification of the lateral border of the pectoralis major and preparation (in a superficial plane laterally towards the anterior border) of the latissimus dorsi, which is exposed.
3. Preparation from the lateral and posterior border of the pectoralis major through the axillary fascia to the lateral border of the pectoralis minor, retraction of the pectoralis major and excision of the interpectoral (Rotter’s) lymph nodes. The lateral pectoral nerve, because it is at risk on the middle and inferior part of the anterior face of the pectoralis minor, should be preserved.
4. Preparation of the lateral border of the pectoralis minor and retraction of the muscle upwards and medially so that the lymphatic tissue behind the muscle (level II) and the axillary vein can be exposed. Some authors propose to raise the arm across the face during this procedure, placing the hand near the opposite shoulder, in order to relax the pectoral muscles and facilitate manipulations on the pectoral muscles. Beyond this border, the pectoralis minor is divided by some surgeons [1]. We estimate that this is not necessary in most cases.
5. Liberation of the anterior and inferior aspects of the axillary vein, extending from the medial border of the pectoralis minor to the anterior border of the latissimus dorsi, without narrowing the vein.
6. The axillary contents are then dissected from the anterior-medial part to the posterior-lateral part, beginning with level II, followed by the tissue adhering to the lateral chest wall and inferior to the axillary vein. The long thoracic nerve, always placed behind the mid-axillary line, must be seen and preserved. However, there is no need for its preparation, because it is shed by the fascia of the serratus anterior muscle, which does not need to be touched during the dissection. Two or three intercosto-brachial nerves can regularly be seen and should be preserved if they are not affected by lymph-node metastases.
7. At the lateral part of the axilla, the thoracodorsal nerve, emerging laterally from behind the axillary vein, must be shown and left intact with accompanying vessels. Usually, 2–3 cm down from the inferior border of the vein, it crosses posteriorly the subscapular veins, which are prominent and mostly easy to identify, thus helping to identify the nerve. If the nerve is seen, it is traced downwards, until it enters the latissimus dorsi.
8. If the dissection inferior to the axillary vein [between the latissimus dorsi and the lateral chest wall, including the tissue behind the pectoralis minor (level II)] is complete, the whole specimen is excised, and the levels and their orientations are marked for histologic examination.
9. Placement of a suction drain, adaptation of the skin flaps with a resorbable suture and intracutaneous suture of the skin are the final procedures of the dissection.