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ORIGINAL ARTICLE

Partial Axillary Dissection after Sentinel Lymph Node Biopsy in Clinically Node-Negative Breast Cancer Patients

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ABSTRACT

Background: The study is to highlight the clinical effect of partial axillary dissection using the new anatomical classification of axillary lymph nodes and not done this study before in Zagazig University Hospital. We aimedto compare between partial dissection and conventional dissection regarding axillary recurrence and postoperative complications.

Methods: This randomized clinical trial done in the Zagazig University Hospital's General Surgery Department between 1/4/2023 to 1/10/2023 and included 60 patients who had partial axillary lymph node dissection and 60 historical controls who had clinically node-negative breast cancer (N0).

Results: Lymphedema, seroma and paresthesia of the inner aspect of the upper arm were significantly decreased in partial dissection than conventional dissection. Wound infection, abscess formation and hematoma formation showed insignificant differences between the two groups.

Conclusion: PALND had similar survival rates and lower complication rates compared with patients with N0 breast cancer ALND. Therefore, in such cases, we advise PALND restricted to the region caudal to the ICBN.

Keywords: Axillary Dissection; Sentinel Lymph Node; Biopsy; Breast Cancer.

INTRODUCTION

Axillary lymph node dissection (ALND), which is a crucial component of surgical operation, has been required ever since the radical mastectomy for patients with breast cancer was first described 100 years ago. Even though arm lymphedema following ALND occurs frequently, prior to the 1970s, most surgeons prioritized patient survival over reducing this serious consequence. Chemotherapy, radiation, and endocrine therapy advancements in the 1980s greatly increased long-term survival. The issue of raising the standard of living for those with early-stage breast cancer has become crucial [1].

In 1983, Rosen et al. [2] split the pectoralis minor muscle-related placement of the axillary lymph nodes (ALNs) into three levels and suggested that ALND be performed gradually from Level I to Level III. Sentinel lymph node biopsy (SLNB), developed in the middle of the 1990s, was found to be the best diagnostic method for precisely staging the axilla and choosing patients with early-stage breast cancer who can avoid needless ALND and its potential danger of arm lymphedema. Sentinel lymph nodes (SLNs) must be correctly identified to treat SLNB. The combination methodology of blue dye and radioactive tracer is much superior to the blue dye alone technique in terms of negative predictive value and overall accuracy for identification of SLNs, even though different methodologies can be utilized for SLNB. Consequently, the blue dye and radioactive tracer combination method is typically regarded as the gold standard for SLNB [3].

However, there is yet no information on the long-term implications of partial axillary lymph node dissection (PALND). The current study sought to determine if PALND is a useful follow-up treatment to SLNB using blue dye as well as the effect of current Chinese practice on SLNB accuracy. To ascertain the false negative rate (FNR) and accuracy rate for SLNB and nodes dissection in relation to intercostobrachial nerve (ICBN), data from patients with clinically node-negative breast cancer were evaluated. Additionally, patients who received SLNB alone, SLNB followed by PALND, or SLNB followed by ALND performed a survival analysis [1].

The trial to arrive at a more conservative treatment of metastatic axillary lymph nodes in breast cancer patients is the key component of this investigation. We anticipate that the results of partial lymph node dissection following sentinel lymph node biopsy will be less difficult than those of complete classical axillary lymph node dissection, with a better final outcome and fewer early and late problems.

Methods

This randomized clinical trial was done in the Zagazig University Hospital's General Surgery Department between 1/4/2023 to 1/10/2023 and included 60 patients who had partial axillary lymph node dissection and 60 historical controls who had clinically node-negative breast cancer (N0). Approval was obtained from the institutional review board (IRB) of the Faculty of Medicine Zagazig University. All patients were scheduled for partial lower axillary lymph node dissection and either a mastectomy or breast-conserving procedure.Written informed consent was obtained from all participants. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Age distribution of those with clinically node-negative breast cancer <60 years were included in the study. Disturbed lymphatics due to previous breast surgery or axillary biopsy, age >60 years, pregnancy and locally advanced disease were excluded.

All patients underwent a thorough history taking process that included name, age, marital status, occupation, gynecological and obstetric history, past medical (use of oral contraceptive pills) and family history, the presenting symptom may be a mass, nipple discharge, pain or a combination, general physical examination, breast examination, ultrasonography, mammography and Tru-cut biopsy of breast mass, chest X ray and pelvi-abdominal ultrasonography.

Technique of Sentinel lymph node biopsy (SLNB):

SLNB was performed for every patient in the study. Under complete aseptic condition, 3-5 ml sterilized 1% methylene blue dye was infiltrated with 23G needle fitted to a syringe and was used to inject into the peritumoral area and in the subcutaneous region of the areola of the diseased breast. To make it easier to see the blue lymphatic veins and lymph nodes, gently touch the injection site for around three minutes. A 3–4 cm transverse incision was made in the axilla just below the hairline in less than 5 minutes. Rounded hemostat and blunt dissection were done to explore the blue colored lymphatic channels and follow it to the blue stained node called sentinel lymph node (s). These nodes were identified and carefully dissected

out and sent for frozen section pathology. The following procedures were performed according to the results of SLNB: PALND if SLNB failed (no blue staining nodes identified), no axillary intervention (SLNB only) The patient's preoperative preference was followed if SLNB was successful and SLN was found to be free of cancer cells by instant frozen histology; otherwise, PALND was performed.

Operative technique:

The intercostobrachial nerve (ICBN) is used to divide the axillary space into an upper part (A) and a lower part (B) **[4].** The ICBN was located at the pectoralis muscle's lateral border in the axilla and was fully exposed in the axillary region. Tape was used to withdraw the nerve. In connection to ICBN, all anatomical sites where soft tissues and lymph nodes were removed were noted. The lower lymph nodes include the lymph nodes that border the ICBN. During the procedure, the long thoracic and thoracodorsal nerves were identified and preserved **(Fig. 1)**.

During the operation, the anatomical variations of ICBN were investigated. All the lymph nodes beneath the ICBN and the axillary fat pad were removed using the PALND procedure. At the conclusion of the procedure, a drainage tube was inserted in the axillary space. The extracted nodes were all transported to frozen pathology and examined for metastasis.

Postoperative:

The results of partial axillary dissection in our study were compared to those of historical controls who had axillary lymph node dissection as per standard practice (ALND) obtained from patients' files in our hospital. The historical controls have had the same criteria as that of our patients.

Statistical Analysis

Statistical analysis was done by SPSS v26 (IBM Inc., Armonk, NY, USA). The Fisher's exact test, Mann Whitney test, Chi-square test, and unpaired student t test were all employed.

Results

Age, marital status, menopause, family history and use of contraceptive pills were insignificantly different between the studied groups ($P \leq 0.05$) **(Table 1).**

There was no significant difference between both groups regarding disease characteristics except postoperative node metastasis that was lower in partial dissection than conventional dissection (P value <0.05) **(Table 2).**

The number and percentage of operations in the two groups showed no significant difference ($P > 0.05$) **(Table 3)**

The number of +ve LNs in the PALND group was significantly lower in the PALND group ($P < 0.001$) **(Table 4)**

In our study, 59 patients with positive SLN underwent PALND. Among them, there were 57 patients whose metastatic axillary nodes were all located inferior to the ICBN, including 18 patients with 1 +ve LNs, 32 patients with 2 +ve LNs, 5 patients with 3 +ve LNs metastatic nodes and 2 patients with 1 +ve LN below and 1 +ve LN above the ICBN. Two patients were found to have no LNs either below or above the ICBN where frozen section biopsy failed. One patient was found to have 1 LN below the ICBN where frozen section biopsy failed **(Table 5)**

The methylene blue staining SLNs were found inferior to the ICBN in 59 patients

(98.3%) and only one stained SLN was found above the ICBN (1.7%) **(Figure 2).**

The number of removed axillary LNs, duration of surgery, postoperative extubation time, analgesics were used, hospital stay, and arm circumference were significantly decreased in partial dissection than conventional dissection.**(Table 6).**

Lymphedema, seroma and paresthesia of the inner aspect of the upper arm were significantly decreased in partial dissection than conventional dissection. Wound infection, abscess formation and hematoma formation showed insignificant difference between the two groups. **(Table 7).**

Table (1): History of the studied groups

Parameter		PALND (n=60)	ALND (n=60)	P value
Age (years)	**Mean ± SD**	44.53 ± 9.75	43.18 ± 8.05	0.410
	Range	32 - 59	30 - 60	
Marital status	**Yes**	24 (40%)	26 (43.3%)	0.711
	No	36 (60%)	34 (56.7%)	
Menopause	**Yes**	26 (43.33%)	33 (55%)	0.201
	No	34 (56.67%)	27 (45%)	
Family History	**Yes**	7 (11.67%)	6 (10%)	0.769
	No	53 (88.33%)	54 (90%)	
Use of CCP	**Yes**	20 (33.3%)	18 (30%)	0.695
	No	40 (66.7%)	42 (70%)	

Table (2): Disease characteristics of the studied groups

Character		Partial dissection (n=60)	Conventional dissection (n=60)	P value
Diameter	**Mean ± SD**	2.52 ± 1.21	2.6 ± 1.07	0.702
	Range	0.5 - 4.3	0.5 - 4.3	
Pathological Types	**IDC**	37 (61.7%)	29 (48.3%)	0.208
	ILC	5 (8.3%)	12 (20%)	
	DCIS	10 (16.7%)	8 (13.3%)	
	Other types	8 (13.33%)	11 (18.3%)	
Histological Grade	**Grade I**	20 (33.33%)	19 (31.7%)	0.846
	Grade II	22 (36.7%)	25 (41.7%)	
	Grade III	18 (30%)	16 (26.7%)	
Postop. Node Metastasis	**Yes**	22 (36.7%)	60 (100%)	**<0.001***
	No	38 (63.3%)	0 (0%)	

Table (3): Type of operation performed for the tumour.

		Partial dissection (n=60)	Conventional dissection (n=60)	P value
Operation	**Total mastectomy**	18 (30%)	14 (23.33%)	0.153
	Quadrantectomy	27 (45%)	21 (35%)	
	Tumorectomy	15 (25%)	25 (41.67%)	

Table (4): Results of frozen section biopsy.

No. of LN metastases	PALND (60)			ALND (60)			P
	Failed	-ve	+ve	Failed	-ve	+ve	
0	2 (66.7%)	0 (0%)	39 (68.4%)	0 (0%)	0 (0%)	0 (0%)	**<0.001***
1	1 (33.3%)	0 (0%)	12 (21.1%)	0 (0%)	0 (0%)	18 (30%)	
2	0 (0%)	0 (0%)	5 (8.8%)	0 (0%)	0 (0%)	32 (53.3%)	
3	0 (0%)	0 (0%)	1 (1.7%)	0 (0%)	0 (0%)	8 (13.3%)	
4	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (3.3%)	
Total No.	3 (5%)	00	57 (95%)	00	00	60 (100%)	

Table (5): Anatomic location of metastatic nodes in patients underwent PALND.

Number of patients (60)	Number of LN metastases	
	Below the ICBN	Above the ICBN
18	1 +ve LN (n=18)	-
32	2 +ve LNs (n=64)	-
5	3 +ve LNs (n=15)	-
2	1 +ve LN (n=2)	1 +ve (n=2)
2	00 LNs (Failed)	00 LNs (Failed)
1	1 LN (1 failed)	-
Total N0. = 60	98 +ve LNs in 57 patients	2 +ve LNs in 2 patients

Table (6): Clinical outcomes of the studied groups

		Partial dissection (n=60)	Conventional dissection (n=60)	P value
Number of LN	**Mean ± SD**	12.57 ± 2.97	22.43 ± 5.56	**<0.001***
	Range	8 - 18	13 - 33	
Duration of surgery (min)	**Mean ± SD**	40.2 ± 12.42	60.82 ± 9.29	**<0.001***
	Range	20 - 60	46 - 75	
Postoperative Extubation time (day)	**Mean ± SD**	5.07 ± 2.16	10.07 ± 2.62	**<0.001***
	Range	2 - 8	6 - 14	
Drainage Volume (ml)	**Mean ± SD**	500.47±87.03	777.52 ± 175.3	**<0.001***
	Range	350 - 634	503 - 1099	
	Range	0 - 0.40	0 - 1	
	Range	0 - 1	0 - 3	
Analgesic use	**Yes**	29 (48.33%)	38 (63.33%)	0.098
	No	31 (51.67%)	22 (36.67%)	
Hospital stay (days)	**Mean ± SD**	2.57 ± 0.5	6.98 ± 1.29	**<0.001***
	Range	2 - 3	3- 8	

Table (7): Complications of the studied groups

		Partial dissection (n=60)	Conventional dissection (n=60)	P value
Lymphoedema	**Transient**	4 (6.7%)	10 (16.7%)	<0.001*
	Persistent	00 (00%)	15 (25%)	
Axillary recurrence		00 (00%)	1 (1.7%)	1.000
Seroma		1 (1.7%)	10 (13.3%)	<0.030*
Paraesthesia of upper inner arm		00 (00%)	30 (50%)	<0.001*
Wound infection		3 (5%)	5 (8.3%)	0.717
Abscess formation		1 (1.7%)	1 (1.7%)	1.000
Hematoma		0 (00%)	1 (1.7%)	1.000

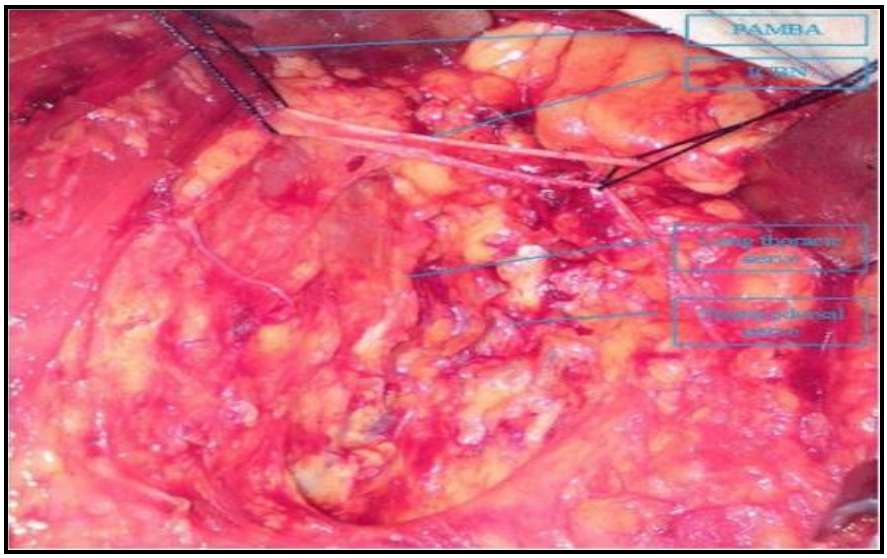

Figure (1): The ICBN identified, dissected and retracted using a tape. Part of axillary lymph node dissection. Illustration: Part of axillary lymph node dissection (PALND) is bordered by intercostobrachial nerve (ICBN) on the upper margin, by the long thoracic nerve on the median margin, and by the thoracodorsal nerve on the posterior margin. The ICBN is revealed completely in the axillary space, and the lymph nodes adjoining the ICBN belong to the lower lymph nodes**.**

Figure (2): Sentinel lymph nodes located inferior to the intercostobrachial nerve. Illustration: SLN is mostly located under the intercostobrachial nerve (ICBN).

DISCUSSION

In our study, no significant differences between PALND and ALND were found as regards all parameters. The reported age was 44.53 ± 9.75 & 43.18 ± 8.05 Respectively. Married patients were 24 (40%) & 26 (43.3%) respectively. Menopausal patients were 43.33% (n=26) in PALND group and 55% (n=33) in ALND group. There was a family history of breast cancer in 11.67% (n=7) & 10% (n=6) respectively. Contraceptive pills were used by 33.3% (n=20) patients in PALND group & 30% (n=18) patients in ALND group (Tab., 1). Our baseline patient characteristics of age and menopausal status are consistent with that of Kodama et al. [5].

In our investigation, there was no discernible difference between the two groups regarding pathological type of the tumor (IDC, ILC, DCIS & other types). These tumor characteristics have no correlation with axillary lymph node metastases as reported by El-Fayoumi [6] and Chen el al. [7] who failed to discover any statistically significant link between these characteristics and lymph node metastases.

Also, the histological grade of the tumor (I, II & III) was insignificant between the two groups in our investigation. Grade II tumors showed the highest incidence in both groups (22 [36.7%] & 25 [41.7%] respectively). El-Fayoumi [6] found a statistically significant relationship between tumor grading and axillary lymph node metastasis that coincided with the study of Roderick et al. [8] but was not compatible with the results of Ishikawa et al. [9] who discovered a non-significant relationship between the tumor grade and lymph node metastasis.

Postoperative node metastases were significantly different between PALND and ALND (22 [36.7%] & 60 [100%] respectively) (P value <0.05). These results are different from that of Kodama et al. [5] who reported +ve postoperative LNs in 18.3% after PALND and 19.1% after ALND without a discernible distinction between the two groups. El-Fayoumi [6] was against our results. He reported an incidence of level I LN metastases (66.6%), which is higher than that of our study (36.7%) and an incidence 33.3% at levels II & III, which is much lower than that of our results (100%). Veronesi et al. (1987) has found 98.5% of his patients (n=539) had metastases in level I nodes after ALND, which is much higher than that of our results (36.7%).

Operations performed for the tumor were simple mastectomy (30% in PALND & 23.3% in ALND) and BCS (70% in PALND & 76.7% in ALND). The number and percentage of these operations in the two groups showed no significant difference. These results go with that of Kodama et al. [5] who performed total mastectomy on 27.2% & 34.2% of his patients respectively and CBS on 76.2% & 65.8% respectively. On the other hand, Li et al. [1] performed simple mastectomy on 81.6% & 71.2% respectively and CBS on 17.1% & 23.7% respectively, which is against our results.

Frozen section biopsy in PALND group failed in 3 (5%) patients and was +ve in 57 (95%) patients with no –ve lymph nodes. In ALND group, there was no failure or -ve frozen section biopsy and all cases was +ve all patients (100%). The number of +ve LNs in the PALND group was significantly lower in the PALND group (P<0.001). Li et al. [1] found 33.3 % of failed SLNB and 30.2 % –ve SLNB (using blue dye), a result which is different from that of our study.

A presentation and supporting studies from the American College of Surgeons Oncology Group (ACOSOG) Z0011 have recently sparked debate on the value of ALND in patients with SLN-positive breast cancer all over the world [10]. It appears that dissection is not necessary when there are fewer than or equal to two positive nodes. All the individuals in our study who had fewer than two positive SLNs had all their metastatic nodes situated below the ICBN. Nodes determined to be superior to the ICBNs were discovered in just three patients with more than two metastatic nodes. PALND is therefore regarded as a method of biopsy for clinically node-negative breast cancer: if there are two or fewer positive nodes, PALND is sufficient; if there are more than two positive nodes, ALND is required.

According to a recent study, adjuvant therapy can have the same effect on overall survival for patients with positive nodes who do not receive ALND as it does for patients with similar node-positive patients [11]. When thinking about radiotherapy and chemotherapy, the existence of positive nodes is one of the crucial considerations.

As long as the ICBNs are preserved, patients' chances of life are unaffected, but the sensory loss and other long-term problems are greatly reduced [12]. Using this technique, axillary lymph nodes dissection may get a new anatomical landmark. Li et al. [4] investigated the anatomic localization of SLNs in relation to the ICBN, they found that the majority of SLNs were located inferior to the ICBN using a dye-tracer technique, and axillary lymph nodes metastases progress from the inferior to the superior axillary as divided by ICBN. This matches the results by Clough et al. [13] who found that roughly 89% of SLNs were located inferior to the ICBN and only a small number were found both superior to the ICBN and outside the subscapular artery.

In our study, 59 patients underwent PALND with positive SLN. There were 57 of them with metastatic axillary nodes that were all situated below the ICBN, including 18

patients with 1 +veLNs, 32 patients with 2 +ve LNs, 5 patients with 3 +ve LNs metastatic nodes and 2 patients with 1 +ve LN below and 1 +ve LN above the ICBN. Two patients were found to have no LNs either below or above the ICBN where frozen section biopsy failed. One patient was found to have 1 LN below the ICBN where frozen section biopsy failed.

Kodama et al. [5] reported LN metastases above the ICBN in 8% of their patients (n=83/1043). A result, which is different from that of our study (3.3% - n=3/60). This difference may be because there were so many patients in their study.

According to our investigation, SLNs were located below the ICBN in all patients except one, which is much higher than that reported by Clough et al. [13]. The larger number of patients in their study could be the cause of this disparity.

In our study, the methylene blue staining SLNs were found inferior to the ICBN in 59 patients (98.3%) and only one stained SLN was found above the ICBN (1.7%). A result which is similar to that of Li et al. [1] who reported 90% stained lymph nodes below the ICBN (n=286/289). On the other hand, Lyman et al. [14] found 8% of patients have node metastases in the region cranial to the intercostobrachial nerve. This was close to the reported false-negative rates for SLNB in their study, which ranged from 5 to 10%.

The duration of surgery in minutes was significantly lower in PALND (40.2 ± 12.42) than in ALND (60.82 ± 9.29) ($p < 0.05$). A result which is like that of Kodama et al. [5] who reported a duration of 41.6 ± 10.8 and 60.9 ± 14.4 respectively.

The postoperative extubation time in days was significantly shorter in PALND than in ALND (range 2-8 & 6-14 days respectively) (P<0.005). This result goes with that of Li et al., 1 who reported a mean of 4.9 ± 1.4 & 10.2 ± 2.7 days in both groups respectively. Also, the drainage volume in ml was significantly lower in PALND than in ALND (500.47 ± 87.03ml & 777.52 ± 175.3 ml respectively) (P<0.05), a result that is nearly like that of Li el al. [1] who reported a drainage volume of 492.8 ± 75.5 ml & 784.75±147.4 ml respectively).

The hospital stay in days showed no significant difference after ALND (2.98 ± 0.89) and PALND (2.57 ± 0.5) with a range of 2-4 & 2-3 respectively (P<0.05).Analgesics were used in 29 (48.33%) after PALND and in 38 (63.33%) after ALND with no notable distinction between the two groups.

In the current study, partial dissection dramatically reduced lymphedema compared to traditional dissection (P value ≤0.05). Mild (transient) oedema was found in 4 patients (6.7%) in PALND and in 10 patients (16.7%) in ALND. Severe (persistent) lymphoedema was not reported among PALND patients but was present in 15 patients (25%) in ALND patients. Overall, postoperative lymphoedema in our study was significantly higher (P<0.05) after ALND than after PALND. A result, which is like that of Li et al. [1] who reported mild oedema in 3.8% & 6.7% and severe oedema in 00% & 30.5% after PALND & ALND respectively). The higher level of lymphoedema observed after ALND group may be explained by the high chemotherapy dose, advanced clinical stage, and subgroups with worse clinicopathological characteristics in this group. Also, in the study of Kodama et al. [5],following partial dissection after SNLNB, postoperative arm lymphoedema was not seen., but 10.9% (n=12) following ALND.

The significant reduction of lymphoedema after PALND may be explained by leaving intact tissues on the ICBN's cranial side and the lymphatic vessel located alongside the axillary vein is not damaged. Ablation of the axillary tissues also prevents postoperative lymphatic leakage. As a result, postoperative arm lymphoedema was not a problem for the patients in the current study who underwent partial dissection.

In our study, there was no axillary recurrence (00%) after PALND but recurrence in one patient (1.7%) in ALND group with There was no discernible distinction between the two groups. These outcomes coincide with that of Li et al. [1] who reported a recurrence of 00% after PALND & ALND. Our result is also comparable to that of Kodama, [5] who reported 0.6% (n=6/1043) of postoperative axillary node recurrence after PALND.

Seroma was reported in 1 patient after

PALND and in 10 patients after ALND with a notable distinction between the two groupings ($P<0.05$). This goes with Hadjiminasand Burke,[15]who reportedmarkedly reduced subcutaneous accumulation of lymphatic fluid in the axilla.Paresthesia of the inner aspect of the upper arm showed a significant difference between the two groups (00% after PALND and 50% after ALND). Wound infection, abscess formation and hematoma following axillary dissection in both partial and conventional groups showed no discernible distinction between the two groups.

Conclusion

In conclusion, the results of this study indicate that PALND in patients with N0 breast cancer is associated with comparable survival rates and lower complication rates than ALND. Therefore, in such cases, we advise PALND restricted to the region caudal to the ICBN. Following SLNB in clinically node-negative breast cancer, axillary node dissection inferior to the ICBN is a good complementary procedure because it offers a better assessment of node status, lowers the incidence of postoperative arm lymphedema, and results in satisfying long-term disease-free survival.

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