Evaluation of the technique of endoscopic axillary sentinel lymph node biopsy in early-stage node-negative breast cancer

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Received: 31 October 2021
Accepted: 30 November 2021
Published: 10 October 2022

The Egyptian Journal of Surgery 2022, 41:247–251

Background
Sentinel lymph node (SLN) biopsy has emerged as an alternative to routine axillary node dissection in early-stage node-negative breast cancer. However, there have been controversies in clinical application because of its various identification rates and false-negative rates. We analyzed endoscopic sentinel node biopsy as a feasible procedure for visualization of the axillary space and resection of the sentinel node using endoscopic technique.
Objective
To evaluate the implementation of the technique and to compare the feasibility, effectiveness, outcome, and complications of endoscopic axillary SLN biopsy versus open technique in early-stage breast cancer.
Patients and methods
Between October 2020 and May 2021, 48 patients with breast cancer with clinically node-negative results were injected methylene blue or patent blue dye.
A total of 24 female patients underwent endoscopic sentinel node biopsy and 24 female patients underwent the traditional method at the breast unit of Department of Surgery at Cairo University Hospitals. The following were evaluated during the study period: feasibility of technique, seroma formation, shoulder mobility, numbness, and pain at the postoperative site.
Results
In 24 patients undergoing the endoscopic technique using insufflation and minimal instrument dissection, the SLN at level I was inspected at its anatomical site and individual lymph nodes were easily identified. One patient developed lateral chest wall infection in the form of cellulitis (4%). The same patient experienced postoperative seroma. Intercostobrachial nerve affection was seen in 29% in the endoscopic method; however, it was 75% in the open method owing to nerve manipulation, not owing to direct injury.
Conclusion
Using endoscopy, we found that this technique allows (a) a minimally invasive working space, (b) recognition of anatomic landmarks, and (c) instrument manipulation within the axilla to identify and extract lymph nodes and apply the sentinel node technique. In almost every case, an excellent anatomical orientation was achieved. The retrieval rate for the sentinel node in endoscopic technique was 100% as found in the open technique.

Keywords:
axillary lymph node biopsy, early-stage breast cancer, endoscopic technique, sentinel

Egyptian J Surgery 2022, 41:247–251

1110-1121

Introduction and background

Sentinel lymph node (SLN) biopsy is considered as the gold standard of care for axillary staging in node-negative early-stage breast cancer as it provides an accurate and less morbid method for staging, avoiding the undesirable complications of routine axillary lymph node dissection (ALND) [1].

If the sentinel node is free from cancer, no ALND is needed, which saves numerous patients from unnecessary operations and postoperative discomfort, or from lifelong problems with pain or arm swelling. With more extensive histopathology of sentinel nodes, the procedure results in a more accurate staging of the axillary region than with ALND. For patients with minimal involvement of the axilla, sentinel lymph node biopsy (SLNB) is increasingly being accepted as the sole surgical treatment of the axilla. However, controversies exist and long-term results are still lacking [2].

Since the ACOSOG Z0011 trial demonstrated ALND was not necessary for certain patients with one to two positive SLNs, then for patients with no palpable

ALNs but indeterminate at ultrasound, SLNB is the first option and may spare further ALND [3].

Conventional open SLNB may result in a small risk of obvious axillary scars, lymphedema, seroma, postoperative pain, paresthesia, and decreased range of motion of the arm. Endoscopic sentinel lymph node biopsy (ESLNB) was developed to reduce the occurrence of these complications. Because of the architecture of the axilla, and the absence of a natural cavity and difficulties in visualization and access, which made it more challenging, recent technical innovations have made it feasible to conduct endoscopic axillary surgery. In addition, very few reports have been published about this technique [4].

This is where this study comes to evaluate the implementation of the technique and to compare the feasibility, effectiveness, outcome, and complications of endoscopic axillary SLN biopsy versus open technique in early-stage female breast cancer.

The study was conducted at Cairo University Hospitals (Kasr Alainy), Faculty of Medicine, Cairo University, between October 1, 2020 and May 1, 2021. The study protocol was reviewed and permitted by the institutional research and ethics committee.

Patients and methods

Patients presented to the breast clinic in Cairo university Hospitals (Kasr Alainy). Triple assessment was done by clinical examination, radiological assessment (sonomammography and contrast study when needed), and tissue biopsy histopathological evaluation. The patient's data were thereafter presented at the weekly multidisciplinary team breast clinic where surgical oncology, medical oncology, radiation oncology, radiology, and pathology physicians attend. This research was performed at the Department of General Surgery, Cairo University Hospitals. Ethical Committee approval and written, informed consent were obtained from all participants.

A total of 48 female patients with breast cancer were included in our final analysis. The patients were recruited into two groups using a closed envelope randomization method: group A patients underwent ESLNB (n=24), and group B patients underwent open SLN biopsy (n=24). Of 24 patients of group A, the ESLNB was achieved via three ports in 16 cases and through two ports in eight cases, with no difference in operating time, number of harvested LNs, or identification rate.

Technique of sentinel lymph node biopsy

Open technique: 3 ml of 1% methylene blue dye or patent blue dye was used in SLNB. The technique is simple, where retro-areolar injection of 1% methylene blue dye or subdermal injection of patent blue dye is administered. After 15 min, a 2-cm transverse incision is made in the axilla below the hair line, followed by opening of the axillary fascia, retrieval of about three LNs, and then closed with no drain. We remove all of the blue-stained LNs, the enlarged LNs, and the LNs with bluish lymphatic streaks nearby (Fig. 1).

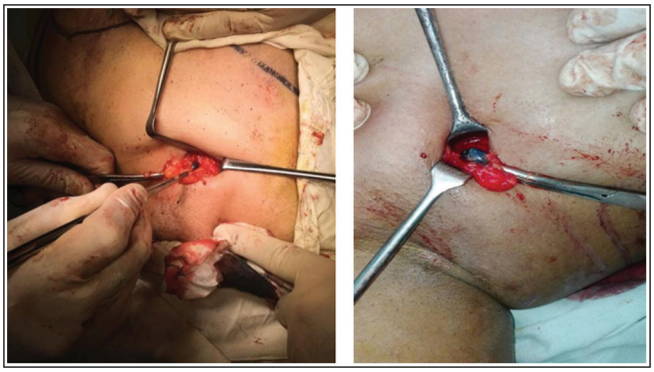
Endoscopic technique: this was done under general anesthesia in supine position with the ipsilateral arm abducted at 90° or more with a soft pad under the shoulder to elevate the arm. All instruments were identical to those commonly used for abdominal laparoscopic surgery. A blue dye was injected as in the open technique mentioned before. Epinephrine (1 : 200 000) was injected into the lateral chest wall near the trocar location to prevent bleeding. A 10-mm trocar of 30° camera was placed caudally in the mid-axillary line at the level of the nipple, just 2 cm below the hair line, and two additional 5-mm trocars are placed at the same level as mentioned before: one in the posterior axillary line and the other in the margin of the mammary areola.

In some cases, we used only one working port, which was a 5-mm trocar at the postaxillary line.

After introduction of the trocars through the subcutaneous tissue and axillary fascia, we used CO_2 insufflation at a pressure of 8 mmHg to widen the working space.

Operations were performed endoscopically using a 5-mm atraumatic forceps and a 5-mm energic device

Figure 1



Intraoperative identification of the blue-stained SLN 15 min after methylene injection in two of our cases. SLN, sentinel lymph node.

(LigaSure, Minneapolis, MN, USA). The position of the SLN is located ~1–2 cm below the hair line usually at intersection between lateral thoracic vessels and intercostobrachial nerve. The working space was widened under direct vision via performing minimal dissection using a LigaSure device.

In ESLNB, we started at the SLN anatomical site and guided by the blue dye, blue-stained sentinel node was resected, and also large and suspicious nonstained lymph nodes at the usual anatomical site of the SLN were removed (Fig. 2).

All operations were performed by the same surgeons experienced in both breast surgery and laparoscopic operation.

The trocar sites differ in every case according to the patient's weight and breast size.

During this study, with our early experience with the endoscopic technique, we used three ports for visualization and manipulation of the SLN, and then we used two ports only, one for visualization and the other for manipulation and retrieval of the SLN.

Results

The included patients had a mean age of 49 ± 12 years old, whereas they had a mean BMI of 35.6 ± 4.3. They were not different in the distribution of comorbidities and clinical T stage, with *P* values of 0.57 and 0.24, respectively.

Regarding the mean of number of harvested lymph nodes, our study reported 3 ± 1 LNs and 4 ± 1 LNs in open technique group and endoscopic group, respectively (Table 1).

Seroma was reported in 4.2% in the endoscopic group, whereas there were no reported cases of seroma in the open technique group.

Intercostobrachial nerve affection was significantly higher in the open SLNB when compared with the endoscopic technique, with *P* value of 0.004 (Fig. 3) (Table 2).

Postoperative pain score (according to numeric rating scale) and operative time were significantly different between both surgical techniques as the pain score was significantly higher in the open technique, with *P* value of 0.006, whereas the operative time was significantly longer in the endoscopic technique (28 ± 12 min)

Figure 2

The relation between the stained LN and the intercostobrachial nerve (a), left. Intraoperative identification of the blue-stained SLN 15 min after patent blue injection, right. SLN, sentinel lymph node.

Table 1 Correlation between surgical techniques for sentinel lymph node dissection and operative details

	Surgical techniques				*P* value
	Endoscopic group A		Open group B		
	Mean	SD	Mean	SD	
BMI	36.0	3.6	35.2	5.0	0.29
Age	53	11	46	12	0.06
Number of dissected LNs	4	1	3	1	0.19
Postoperative pain score	3	1	5	1	0.006
Operative time (min)	28	12	20	8	0.012

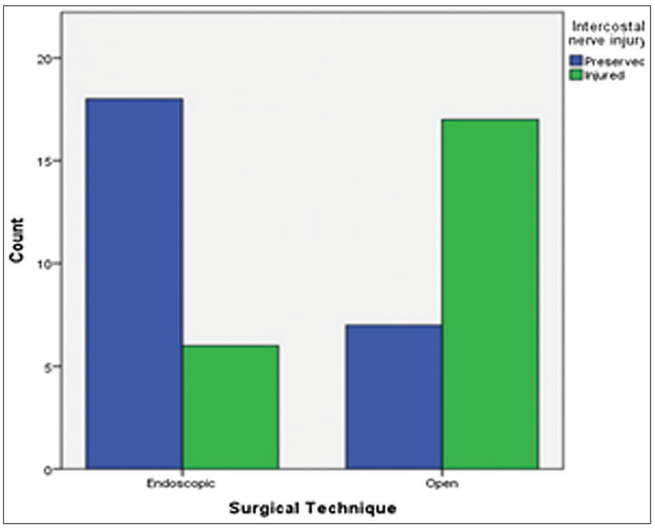
compared with the open technique (20 ± 8 min), with *P* value of 0.012.

Discussion

Surgery is still the first choice for the treatment of early breast cancer, but the scope of surgery is moving toward minimally invasive and better cosmetic preservation on the premise of treatment effect. In the past 20 years, many research studies have confirmed that SLNB is accurate and safe to predict whether patients with breast cancer can avoid ALND, which would bring favorable outcome and protection of more functions [5].

SLNB has been the standard process of breast cancer surgery recommended by ESMO clinical practice guidelines [6].

Figure 3



Bar chart showing incidence of intercostobrachial nerve affection among groups A and B.

In this ESLNB technique, we chose the axillary approach, as it remains the most common incision while approaching the axilla. In comparison between Liang and colleagues technique (periareolar incision) and this study, we found that the technique we used was much better in aspects of exposure of operating space, the operating time, number of harvested lymph nodes, and cosmetic results.

We faced some challenges with the site of port insertion and creating axillary space; the trocar sites were modified several times to reach the optimum site.

In the initial cases, we used three ports (16 patients) – one for the scope (at the mid-axillary line 2 cm below the hair line) and two working ports: one at the posterior axillary line and one through a periareolar incision. The scope port was almost fixed at the mid-axillary line 2 cm below the hair line, whereas the working ports sites varied according to the patient's body weight and breast size. Finally, we achieved the technique using one working port only at a fixed site at the posterior axillary line. In contrast, Liang and Xu [7] used two trocars (10 mm one and 5 mm the other) that were placed in the cavity through the periareolar incision, and a third trocar was placed in the cavity through another 5-cm incision located on the anterior axillary line.

Subcutaneous epinephrine 1 : 200 000 was injected in the axilla and lateral chest wall to widen the working space and allow insertion of trocars easily through the avascular plane. The ports were inserted through the subcutaneous tissue and axillary fascia. The working space is widened at the location of the SLN by using CO_2 insufflation at an 8-mmHg pressure.

Table 2 Correlation between surgical techniques for sentinel lymph node dissection and baseline characteristics

	Surgical techniques [*n* (%)]		*P* value
	Endoscopic: group A	Open: group B	
Comorbidity			
None	17 (70.83)	18 (75)	0.57
HTN	7 (29.16)	5 (20.83)	
DM	0	1 (4.1)	
Clinical T stage			
T1	3 (12.5)	6 (25.0)	0.24
T2	17 (70.8)	12 (50.0)	
T3	4 (16.6)	6 (25.0)	
Seroma			
No	23 (95.8)	24 (100.0)	0.13
Yes	1 (4.1)	0	
Paresthesia due to intercostobrachial nerve manipulation			
Nerve preserved	17 (70.83)	6 (25.0)	0.004
Nerve affected	7 (29.16)	18 (75.0)	

DM, diabetes mellitus; HTN, hypertension.

We encountered some technical difficulties with the third port (the periareolar one) especially in patients with upper outer quadrant masses to achieve oncological safety and in patients with large breast size.

Then, it was found that it was feasible to achieve the technique using two ports only (eight cases) – one for the scope and one working port for manipulation and retrieval of the sentinel node (at the posterior axillary line).

This change in the number of working ports did not affect the outcome regarding the operative time, the number of retrieved LNs, or intraoperative or postoperative complications.

Regarding the mean of number of harvested lymph nodes in endoscopic group, this study reported 4± however, the studies by Liang and colleagues and Fang and colleagues reported 3.5 ± 0.6 and 2.3 ± 1.4, respectively. In the open technique group, this study reported 3 ± 1 LNs.

In this study, the retrieval rate was 100%, which was higher than that reported by Tsangaris *et al.* [8], Fang *et al.* [4], and Liang and colleagues, which was 57.6, 80, and 88%, respectively, and similar to that of conventional SLNB with blue dye.

In this study, the operative time in the open technique group was 20 ± 8 min, whereas it was significantly longer in ESLNB (28 ± 12 min), with a *P* value of 0.012. Liang and Xu [7] reported that the mean endoscopic operative time was 29.56 ± 5.82 min. Luo *et al.* [9] found no statistically significant differences between the open technique and endoscopic groups with respect to operative time (31.18 vs. 40.63 min, respectively). Fang *et al.* [4] reported that intercostobrachial nerve injury was 25%, which is slightly less than that in this study (29%).

Regarding seroma formation, this study found that there was no significant difference between the open technique and the endoscopic technique. This was also stated by Luo *et al.* [9].

By the end of this study, we found that the endoscopic approach is a feasible, productive, and reproducible technique, with significantly less postoperative pain, lower chance of intercostobrachial nerve affection, and an acceptable harvest.

Conclusion

This study suggests the use of the ESLNB technique as an alternative to the conventional open technique as it is a reliable and accurate technique allowing immediate identification of sentinel axillary lymph node. However, it requires experience. In skilled hands, the technique is almost comparable to the routine open technique, with its advantages of minimal morbidity and intraoperative complications. This study did encourage our team to start to achieve the ALND endoscopically.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Tsujimoto M. Recent advances in sentinel node biopsy in breast surgery. Breast Cancer (Tokyo, Japan) 2015; 22:211.

2 Bergkvist L, Frisell J. Management of the axilla: sentinel lymph node biopsy. In: Wyld L, Markopoulos C, Leidenius M, Senkus-Konefka E, (editors). Breast cancer management for surgeons. Cham: Springer. 2018:275–284.

3 Liang Y, Chen X, Tong Y, Zhan W, Zhu Y, Wu J, *et al*. Higher axillary lymph node metastasis burden in breast cancer patients with positive preoperative node biopsy: may not be appropriate to receive sentinel lymph node biopsy in the post-ACOSOG Z0011 trial era. World J Surg Oncol 2019; 17:37.

4 Fang J, Ma L, Zhang YH, Yang ZJ, Yu Y, Cao XC. Endoscopic sentinel lymph node biopsy and endoscopic axillary lymphadenectomy without liposuction in patients with early stage breast cancer. Surg Oncol 2017; 26:338–344.

5 Kuehn T, Vogl FD, Helms G, Pueckler SV, Schirrmeister H, Strueber R, *et al*. German multi-institutional trial (2004). Sentinel-node biopsy for axillary staging in breast cancer: results from a large prospective German multi-institutional trial. Eur J Surg Oncol 2004; 30:252–259.

6 Senkus E, Kyriakides S, Ohno S, Penault-Llorca F, Poortmans P, Rutgers E, *et al*. ESMO Guidelines Committee (2015). Primary breast cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. Ann Oncol 2015; 26(Suppl 5):v8–v30.

7 Liang Y, Xu S. Nonliposuction endoscopic sentinel lymph node biopsy through the periareolar incision. Surg Innov 2020; 27:570–579.

8 Tsangaris TN, Trad K, Brody FJ, Jacobs LK, Tsangaris NT, Sackier JM. Endoscopic axillary exploration and sentinel lymphadenectomy. Surg Endosc 1999; 13:43–47.

9 Luo C, Guo W, Yang J, Sun Q, Wej W, Wu S, *et al*. Comparison of mastoscopic and conventional axillary lymph node dissection in breast cancer: long-term results from a randomized, multicenter trial. Mayo Clin Proc 2012; 87:1153–1161.