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Original Article

To Study the Feasibility and Accuracy of Axilloscopy as a Diagnostic Modality in Breast Tumours for Sentinel Lymph Node Biopsy and Lower Axillary Sampling

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ABSTRACT

Background: Breast cancer is the most common malignancy among women worldwide and accurate axillary lymph node assessment plays a crucial role in staging, prognosis, and treatment planning. Conventional axillary lymph node dissection is associated with significant morbidity, leading to increasing interest in minimally invasive techniques such as axilloscopy for sentinel lymph node biopsy and lower axillary sampling. This study aimed to evaluate the feasibility and diagnostic accuracy of axilloscopy as a minimally invasive diagnostic modality for sentinel lymph node biopsy and lower axillary sampling in breast cancer patients.
Methods: This hospital-based cross-sectional study was conducted in the Department of General Surgery, M.G.M. Memorial Medical College and M.Y. Hospital, Indore, over a period of one year. A total of 45 breast cancer patients undergoing Modified Radical Mastectomy (MRM) or Breast Conservation Surgery (BCS) were included. Patients underwent axilloscopy using endoscopic techniques for sentinel lymph node biopsy and lower axillary sampling. Demographic details, tumor characteristics, lymph node retrieval, nodal metastasis, and diagnostic accuracy parameters were evaluated. Statistical analysis was performed using SPSS version 21.0.
Results: The majority of patients belonged to the 41–50 years age group (33.3%). Ductal carcinoma was the predominant histopathological type (95.6%). Breast-conserving surgery was performed in 62.2% of patients. Up to four lymph nodes were retrieved in 57.8% of cases, while metastasis was detected in 80% of patients on axilloscopy. The procedure demonstrated excellent diagnostic performance with sensitivity of 97.3%, specificity of 100%, positive predictive value of 100%, negative predictive value of 88.89%, and overall accuracy of 97.78%.
Conclusion: Axilloscopy is a feasible, safe, and highly accurate minimally invasive technique for sentinel lymph node biopsy and lower axillary sampling in breast cancer patients. It provides reliable axillary assessment while potentially reducing the morbidity associated with conventional axillary dissection.

Keywords: *Breast cancer; Axilloscopy; Sentinel lymph node biopsy; Axillary lymph node dissection; Minimally invasive surgery.*

INTRODUCTION

Breast cancer (BC) has emerged as the most prevalent malignancy worldwide, surpassing lung cancer with approximately 2.3 million new cases reported in 2020, accounting for 11.7% of all cancer cases.[1] In 2022, nearly 2.3 million women were diagnosed with breast cancer globally, while approximately 670,000 deaths were attributed to the disease.[2] It remains the second leading cause of cancer-related mortality among women worldwide.[3] The 5-year and 10-year relative survival rates for women with invasive breast cancer are reported to be 91% and 84%, respectively.[2] Breast cancer

incidence continues to rise globally, particularly among women younger than 50 years of age.[3] In India, the burden of breast cancer has increased substantially over the past few decades, with a marked rise in incidence and mortality rates.[4-6] According to GLOBOCAN 2022 data, India recorded one of the highest numbers of breast cancer-related deaths among women worldwide.[6]

Management of breast cancer has evolved significantly from radical mastectomy to breast-conserving surgery and minimally invasive axillary procedures aimed at improving cosmetic outcomes, reducing morbidity, and preserving quality of life.[7] Accurate axillary staging plays a critical role in determining disease spread, planning adjuvant therapy, and predicting prognosis. Traditionally, axillary lymph node dissection (ALND) was performed for staging and regional disease control. However, conventional open axillary surgery is associated with complications such as lymphedema, seroma formation, postoperative pain, numbness, restricted shoulder movement, and poor cosmetic outcomes. [8-10]

The introduction of sentinel lymph node biopsy (SLNB) and minimally invasive endoscopic approaches has transformed axillary management in breast cancer.[11] Sentinel lymph node biopsy has become the gold standard for axillary staging in clinically node-negative breast cancer patients because it allows selective removal of the first draining lymph node while minimizing surgical morbidity.[12] In parallel, endoscopic axillary techniques such as axilloscopy and endoscopic axillary lymphadenectomy have gained attention as minimally invasive alternatives capable of providing adequate visualization and sampling of axillary lymph nodes.[9,10]

Axilloscopy offers the advantage of enhanced visualization of axillary structures through a minimally invasive approach, potentially reducing complications and improving postoperative recovery. Moreover, it may facilitate lower axillary sampling and sentinel node identification with reduced tissue trauma.[13] Despite these potential advantages, concerns remain regarding operative duration, adequacy of nodal clearance, technical feasibility, and long-term oncological outcomes. Therefore, further evaluation is necessary to determine the effectiveness and accuracy of axilloscopy in comparison with conventional axillary procedures. In this context, the present study was undertaken to evaluate the feasibility and diagnostic accuracy of axilloscopy in breast tumours for sentinel lymph node biopsy and lower axillary sampling.

MATERIAL AND METHODS

This hospital-based cross-sectional study was conducted in the Department of General Surgery at M.G.M. Memorial Medical College and M.Y. Hospital, Indore, over a period of one year after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all patients in their vernacular language prior to inclusion in the study. A total of 45 patients with breast carcinoma undergoing Modified Radical Mastectomy (MRM) or Breast Conservation Surgery (BCS) with axillary evaluation were enrolled to assess the feasibility and accuracy of axilloscopy for sentinel lymph node biopsy and lower axillary sampling.

Sample size was calculated using Cochrane's formula and finalized based on the expected patient load and feasibility during the study period. A total of 45 patients were included to adequately evaluate the efficacy, diagnostic accuracy, and complications associated with axilloscopy.

Inclusion Criteria

- Age more than 18 years
- Patients with breast carcinoma planned for MRM or BCS
- Patients with no clinically palpable axillary lymph node disease
- Patients with axillary lymph nodes less than 1 cm on ultrasonographic evaluation
- Patients willing to participate and provide informed consent

Exclusion Criteria

- Patients lost to follow-up
- Patients with palpable axillary lymph nodes
- Patients with bleeding diathesis
- Patient with locally advanced breast disease,
- Patient with metastatic disease

METHODOLOGY

Preoperative evaluation and preparation

All patients underwent detailed preoperative assessment including demographic details, clinical history, physical examination, and radiological evaluation. Tumor characteristics including tumor stage and axillary lymph node status were documented. Laboratory investigations included complete blood count, renal function tests, liver function tests, blood sugar levels, coagulation profile, and viral markers as per institutional protocol. Ultrasonographic evaluation of the axilla was performed in all patients to assess lymph node involvement. Pre-anesthetic evaluation was conducted prior to surgery.

Procedure and intraoperative assessment
All procedures were performed under general anesthesia with the patient placed in a supine position. Axilloscopy was carried out using minimally invasive endoscopic techniques. Small incisions were made in the axillary region, and liposuction was initially performed to remove excess axillary fat and create an adequate working space. An endoscope was introduced through the liposuction incision, while additional trocars were inserted through separate small incisions.

Under endoscopic visualization, fibrous tracts, small lymphatic channels, and blood vessels were carefully coagulated and divided. Sentinel lymph nodes and lower axillary lymph nodes were identified, dissected, and removed. The surgical field was irrigated with saline following completion of the procedure, and the incisions were sutured. Intraoperative parameters including operative duration, adequacy of visualization, lymph node retrieval, and intraoperative complications were recorded.

Postoperative monitoring
Postoperatively, patients received appropriate antibiotics, analgesics, and supportive care according to institutional protocol. Patients were monitored for postoperative complications including seroma formation, wound infection, pain, numbness, restricted shoulder movement, and lymphedema. Clinical assessment was carried out during hospital stay and follow-up visits.

Functional and pathological assessment
The number of lymph nodes retrieved and the number of metastatic lymph nodes detected were recorded from histopathological examination. The diagnostic accuracy of axilloscopy was assessed by comparing its sensitivity and specificity with conventional axillary clearance for detection of nodal metastasis. Tumor staging and pathological findings were also documented.

Outcomes
The primary outcome measured was the feasibility and accuracy of axilloscopy for visualization of the axillary space and sentinel lymph node biopsy with lower axillary sampling. Secondary outcomes included assessment of efficacy, lymph node retrieval rate, detection of nodal metastasis, operative complications, postoperative morbidity, and overall safety of the procedure.

Statistical Analysis
All collected data were entered into Microsoft Excel and analyzed using SPSS software version 21.0 (IBM Corporation, Chicago, IL). Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Descriptive and inferential statistical analyses were performed using appropriate statistical tests, including independent t-test where applicable. Results were represented using tables, charts, and graphs. A p-value <0.05 was considered statistically significant with a 95% confidence interval.

Figure 1: Axilla after clearance of fat and lymph nodes

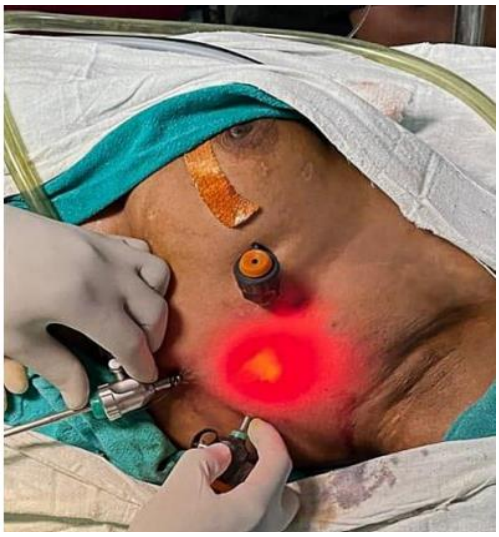

Figure 2: 20 cm instruments inserted through 5 mm ports in axilla

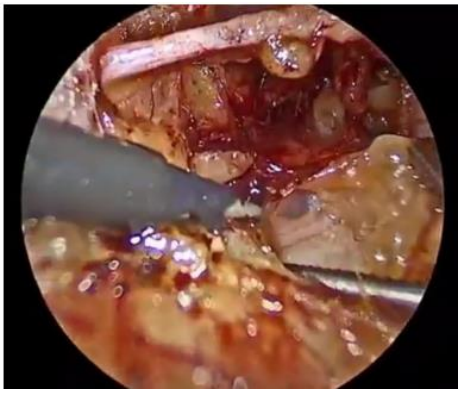

Figure 3: Axillary vein visible, marking the upper limit of dissection

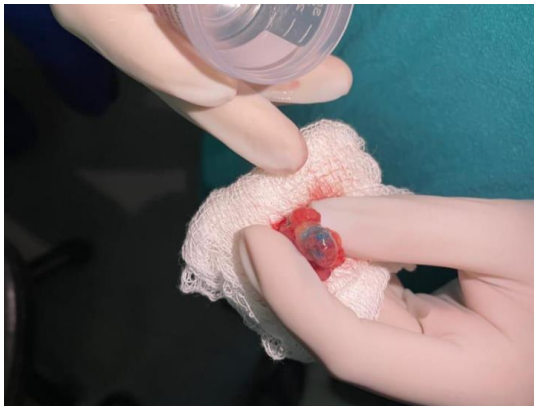

Figure 4: Sentinel lymphnode identified after uptake of methylene blue dye

Figure 5: Sites of ports and drain insertion post axilloscopy

Figure 6: Axilla post clearance

RESULTS

The present study included 45 patients with breast carcinoma who underwent axilloscopy for sentinel lymph node biopsy and lower axillary sampling. All patients were evaluated for demographic profile, tumor characteristics, surgical management, lymph node involvement, and diagnostic accuracy of axilloscopy in comparison with complete axillary dissection.

The majority of patients belonged to the 41–50 years age group (33.3%), followed by 31–40 years and 51–60 years age groups (22.2% each). Ductal carcinoma was the predominant histopathological diagnosis observed in 95.6% of patients, while lobular carcinoma accounted for 4.4% of cases. Breast conservation surgery (BCS) was performed in 62.2% of patients, whereas modified radical mastectomy (MRM) was done in 37.8%. Neoadjuvant chemotherapy was administered in 37.8% of cases. [Table 1]

Table 1: Demographic, Histopathological and Surgical Profile of Study Subjects (N = 45)

Parameter	Category	Frequency (n)	Percentage (%)
Age group	20–30 years	6	13.3
	31–40 years	10	22.2
	41–50 years	15	33.3
	51–60 years	10	22.2
	>60 years	4	8.9
Tissue diagnosis	Ductal carcinoma	43	95.6
	Lobular carcinoma	2	4.4
Type of surgery	BCS	28	62.2
	MRM	17	37.8
Neoadjuvant chemotherapy	Yes	17	37.8
	No	28	62.2

Tumor staging revealed that most patients had early-stage disease. T1 tumors were observed in 55.6% of patients, followed by T2 tumors in 37.8% and T3 tumors in 6.6%. Grade I breast cancer was noted in 77.8% of cases, whereas Grade II disease was observed in 22.2%. [Table 2]

Table 2: Tumor Characteristics and Staging of Study Subjects

Parameter	Category	Frequency (n)	Percentage (%)
Pathological tumor stage	T1	25	55.6
	T2	17	37.8
	T3	3	6.6
Stage of breast cancer	Grade I	35	77.8
	Grade II	10	22.2

Axilloscopy findings demonstrated that up to 4 lymph nodes were retrieved in 57.8% of patients, while more than 4 lymph nodes were retrieved in 42.2% of cases. Metastatic lymph node involvement on axilloscopy was detected in 80% of patients, whereas complete axillary dissection showed nodal metastasis in 82.2% of patients. [Table 3]

Table 3: Axilloscopy and Axillary Dissection Findings

Parameter	Category	Frequency (n)	Percentage (%)
Number of lymph nodes retrieved during axilloscopy	Up to 4	26	57.8
	>4	19	42.2
Lymph node metastasis on axilloscopy	Yes	36	80.0
	No	9	20.0

Lymph node metastasis on complete axillary dissection	Yes	37	82.2
	No	8	17.8

The diagnostic performance of axilloscopy was excellent when compared with complete axillary dissection. Sensitivity was 97.3%, specificity was 100%, and overall diagnostic accuracy was 97.78%. The positive predictive value was 100%, while the negative predictive value was 88.89%. Only one false-negative case was identified. [Table 4]

Table 4: Diagnostic Accuracy of Axilloscopy for Detection of Lymph Node Metastasis

Statistic	Value	95% Confidence Interval
Sensitivity	97.30%	85.84% – 99.93%
Specificity	100.00%	63.06% – 100.00%
Disease prevalence	82.22%	67.95% – 92.00%
Positive Predictive Value	100.00%	90.26% – 100.00%
Negative Predictive Value	88.89%	53.65% – 98.22%
Accuracy	97.78%	88.23% – 99.94%

Overall, the study demonstrated that axilloscopy is a highly feasible and accurate minimally invasive technique for sentinel lymph node biopsy and lower axillary sampling in breast cancer patients. The procedure showed excellent sensitivity and specificity for detecting nodal metastasis while potentially minimizing the morbidity associated with conventional axillary dissection.

DISCUSSION

Sentinel lymph node biopsy has become an important advancement in the surgical management of breast cancer because it allows accurate assessment of axillary lymph node involvement while reducing the morbidity associated with conventional axillary lymph node dissection (ALND).[12] However, despite its advantages, concerns regarding false-negative results and postoperative complications still persist. Consequently, minimally invasive endoscopic techniques such as axilloscopy are increasingly being explored as alternatives for axillary staging and lymph node assessment. The present study was undertaken to evaluate the feasibility and diagnostic accuracy of axilloscopy in breast cancer patients undergoing sentinel lymph node biopsy and lower axillary sampling.

In the present study, the majority of patients belonged to the 41–50 years age group, followed by the 31–40 years and 51–60 years age groups. These findings indicate that breast cancer predominantly affected middle-aged women. Similar observations were reported by Chen Y et al,[14] who documented a mean patient age of 44.81 years, while Lee EK et al,[16] reported a mean age of 45 years among patients undergoing endoscopic breast surgery. Ashturkar AV et al,[15] also observed that more than half of breast cancer patients were younger than 50 years. These findings suggest that breast cancer continues to affect relatively younger women, particularly in developing countries.

Histopathological analysis in the present study revealed that ductal carcinoma was the predominant subtype, accounting for 95.6% of cases, whereas lobular carcinoma constituted only a small proportion. Similar findings were reported by Li H et al,[16] who found invasive ductal carcinoma to be the commonest histological subtype in 89.29% of patients. Ashturkar AV et al,[15] also reported infiltrating duct carcinoma as the predominant histological pattern. The predominance of ductal carcinoma observed across studies reflects the established epidemiological pattern of breast malignancies worldwide.

The present study demonstrated that breast-conserving surgery (BCS) was performed more frequently than modified radical mastectomy (MRM). This trend reflects the growing preference for conservative surgical approaches whenever oncologically feasible. In contrast, Kadam SS et al,[17] reported greater preference for MRM among patients because of fear of recurrence and concerns regarding radiation therapy. However, several studies have demonstrated comparable disease-free survival and overall survival rates between BCS and MRM.[18] Corradini S et al,[19] further reported improved local control and overall survival in patients treated with BCS followed by radiotherapy. Additionally, Ohsumi S et al,[20] emphasized the cosmetic and psychological advantages associated with breast-conserving procedures.

Axillary lymph node involvement remains one of the most significant prognostic indicators in breast cancer management.[21] Accurate evaluation of axillary metastasis is therefore essential for determining staging, prognosis, and the need for adjuvant therapy. Sentinel lymph node biopsy has become the standard approach for staging clinically node-negative breast cancer patients.[22] Nevertheless, even SLNB can result in complications such as lymphedema, pain, seroma formation, paresthesia, and restricted shoulder movement.[23] Hence, minimally invasive techniques such as axilloscopy may provide an effective alternative while minimizing surgical morbidity.

In the present study, axilloscopy enabled successful retrieval of lymph nodes in all patients. Up to four lymph nodes were retrieved in more than half of the cases, while the remaining patients had retrieval of more than four lymph nodes. Chen Y et al,[24] reported a mean retrieval of 3.33 sentinel lymph nodes per patient during endoscopic procedures. Similarly, Aponte-Rueda ME et al,[25] demonstrated that axilloscopy yielded lymph node counts comparable to open surgery,

although fractured nodes were encountered more frequently during endoscopic retrieval. These findings suggest that axilloscopy is technically feasible and capable of adequate lymph node sampling.

The present study demonstrated metastatic lymph node involvement in 80% of patients on axilloscopy and 82.2% following complete axillary dissection. The high prevalence of nodal metastasis may be related to delayed presentation of patients at tertiary care hospitals. Iwasaki Y et al,[26] reported axillary metastasis rates ranging from 18% to 38.5% in pT1 breast cancers. Salvat J et al,[27] also observed that endoscopic and open surgical approaches yielded comparable lymph node retrieval, although endoscopic procedures required longer operative duration. Despite technical challenges, endoscopic approaches provide benefits such as smaller incisions, improved cosmetic outcomes, and potentially lower postoperative morbidity.

Most tumors in the present study were categorized as T1 lesions, followed by T2 and T3 tumors, indicating relatively early-stage disease in the majority of patients. Similar findings were reported by Ashturkar AV et al,[15] who observed T2 tumors as the most common presentation. Carter CL et al,[28] demonstrated that increasing tumor size is associated with a higher incidence of axillary lymph node metastasis and poorer survival outcomes, thereby highlighting the importance of early diagnosis and treatment.

One of the major findings of the present study was the high diagnostic accuracy of axilloscopy. The procedure demonstrated a sensitivity of 97.3%, specificity of 100%, and overall diagnostic accuracy of 97.78%, with only one false-negative result. Similar findings were reported by Li H et al,[16] who observed high diagnostic accuracy for axillary assessment using endoscopic techniques. Hussein O et al,[29] demonstrated an 80% identification rate with endoscopic sentinel node biopsy, while Woo HD et al,[30] reported a sentinel node identification rate of 94.3% with a low false-negative rate. These findings support the reliability of axilloscopy for assessment of axillary nodal status.

Overall, the present study supports the feasibility, safety, and high diagnostic accuracy of axilloscopy as a minimally invasive technique for sentinel lymph node biopsy and lower axillary sampling in breast cancer patients. The procedure provides effective visualization of the axillary space with reliable lymph node assessment while potentially reducing the complications associated with conventional axillary dissection. Further large-scale prospective studies are recommended to establish its long-term oncological safety and wider clinical applicability.

CONCLUSION

In conclusion, the present study demonstrated that axilloscopy is a feasible, safe, and highly accurate diagnostic modality for sentinel lymph node biopsy and lower axillary sampling in breast cancer patients. The procedure provided effective visualization of the axillary space with excellent diagnostic performance, showing a sensitivity of 97.3% and specificity of 100% for detection of nodal metastasis. Most patients presented with early-stage ductal carcinoma and underwent breast-conserving surgery. Axilloscopy allowed reliable lymph node retrieval while potentially minimizing the morbidity associated with conventional axillary dissection. These findings support its role as a valuable minimally invasive technique in modern breast cancer management.

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