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EARLY OUTCOMES OF SINGLE-PORT ENDOSCOPIC NIPPLE-SPARING MASTECTOMY WITH IMMEDIATE IMPLANT-BASED RECONSTRUCTION IN EARLY-STAGE BREAST CANCER: A CASE SERIES

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ABSTRACT

Objectives: To evaluate the early outcomes of single-port endoscopic nipple-sparing mastectomy combined with immediate implant-based reconstruction in patients with early-stage breast cancer.

Subjects and Methods: A retrospective descriptive case-series study was conducted on 14 patients with early-stage breast cancer who underwent single-port endoscopic skin-sparing mastectomy with preservation of the nipple–areolar complex and immediate implant-based reconstruction from April 2024 to September 2024. Study variables included clinical and paraclinical characteristics, surgical outcomes, intraoperative and postoperative complications, cosmetic outcomes, and quality of life assessed using the Breast-Q questionnaire.

Results: The mean age of the study population was 41.6 years. The mean BMI was 20.1 ± 1.6. The mean tumor size was 1.7 ± 0.4 cm, and most patients were classified as stage T1 (85.7%). The mean operative time was 250.5 ± 23.3 minutes, and the mean estimated blood loss was 32.2 ± 5.6 mL. No cases required conversion to open surgery. The mean postoperative hospital stay was 8.55 ± 0.6 days. Early complications included seroma formation (15%), partial nipple necrosis (7.5%), and surgical site infection (7.5%). No cases of total nipple necrosis, skin flap necrosis, or postoperative bleeding were observed. After 3 months, 78.6% of patients achieved good cosmetic outcomes according to the Lowery-Carlson scale. Breast-Q scores in the immediate reconstruction group were significantly higher than those in the non-reconstruction group.

Conclusion: Single-port endoscopic nipple-sparing mastectomy combined with immediate implant-based reconstruction is a feasible and safe approach in appropriately selected patients with early-stage breast cancer. The technique provides favorable cosmetic outcomes, acceptable complication rates, and improved postoperative quality of life.

Keywords: Breast cancer; single-port endoscopic surgery; nipple-sparing mastectomy; immediate reconstruction; implant-based reconstruction.

1. INTRODUCTION

Nipple-sparing mastectomy (NSM) with immediate implant-based reconstruction has become an increasingly important surgical option for selected patients with early-stage breast cancer because it combines oncologic safety with improved cosmetic and psychosocial outcomes. Recently, minimally invasive approaches such as single-port endoscopic NSM have been developed to further reduce surgical trauma and improve aesthetic results by concealing the incision within the axillary region and avoiding visible breast scars [1, 2]. Previous studies have demonstrated that endoscopic and minimally invasive NSM techniques provide comparable oncologic outcomes to conventional mastectomy while reducing complications such as nipple necrosis, prosthesis exposure, and wound-related morbidity [3, 4]. In addition, patient-reported outcomes after minimally invasive breast reconstruction have shown high satisfaction with breast appearance, scar quality, and postoperative quality of life [5].

Despite increasing international experience, studies on single-port endoscopic surgery in the treatment of breast cancer remain limited in Vietnam. Evaluating the feasibility, safety, and early clinical outcomes of this technique in local clinical settings is therefore important. In the present study, most tumors were early-stage lesions with favorable biological characteristics, and patients underwent single-port endoscopic nipple-sparing mastectomy combined with immediate implant-based reconstruction. Therefore, we conducted this study to evaluate the early outcomes of this technique, including operative characteristics, postoperative complications, cosmetic outcomes, and quality-of-life results in patients with early-stage breast cancer.

2. SUBJECTS AND METHODS

2.1. Study Subjects and Design

This retrospective descriptive case-series study included 14 patients with early-stage breast cancer who

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underwent single-port endoscopic skin-sparing nipple-sparing mastectomy combined with immediate implant-based reconstruction at the Department of Surgery B from April 2024 to September 2024. Eligible patients were those with histopathologically confirmed breast cancer at stage 0, I, or II, with a tumor-to-nipple–areolar complex distance >2 cm, breast size cup A–B, no skin or pectoralis muscle invasion, and complete medical records. All patients underwent single-port endoscopic nipple-sparing mastectomy with immediate implant-based reconstruction. Patients were excluded if they had stage IV breast cancer, central tumors or invasion of the nipple–areolar complex, diffuse microcalcifications, nipple discharge, or large breast volume (cup C–D).

2.2. Surgical Procedure

Patients underwent general endotracheal anesthesia and were positioned with the arm abducted at 90–135°. A skin incision measuring approximately 3.5–5 cm was created at the axillary fold or anterior axillary line. After dissection to create the working space, the single-port system was inserted and CO_2 insufflation was maintained at a pressure of 8–12 mmHg.

The entire breast gland was dissected from the pectoralis major fascia and subcutaneous tissue under endoscopic guidance. After completion of nipple-sparing mastectomy with preservation of the nipple–areolar complex, the breast specimen was removed through the axillary incision. Axillary management was performed through the same approach using sentinel lymph node biopsy. Immediate implant-based breast reconstruction was subsequently performed.

2.3. Data Analysis

Data were coded and analyzed using SPSS version 20.0. Quantitative variables were expressed as mean ± standard deviation, while qualitative variables were presented as percentages. A p-value <0.05 was considered statistically significant.

3. RESULTS

Table 1. General Characteristics of the Study Population

Characteristics					
Subgroup/ Index	**n**	**%**	**Mean ± SD**	**MIN**	**MAX**
Age					
21–30	1	7.1			
31–40	6	42.9			
≥41	7	50.0	41.6 ± 6.2	21	52
BMI					
BMI	14	100	20.1 ± 1.6	18.2	22.5
Breast size					
Bra cup size	14	100	33.1 ± 0.8	32	36

As shown in Table 1, the mean age of the patients was 41.6 ± 6.2 years, with patients aged ≥41 years accounting for the highest proportion (50.0%). Patients aged 31–40 years represented 42.9% of the study population, while only one patient was younger than 30 years. The mean BMI was 20.1 ± 1.6, indicating that most patients had a relatively lean body habitus. The mean bra cup size was 33.1 ± 0.8, with values ranging from 32 to 36, reflecting the predominance of small-to-moderate breast volume among selected patients undergoing single-port endoscopic nipple-sparing mastectomy with immediate implant-based reconstruction.

Table 2. Histopathological Characteristics of the Tumors

Histopathological Results	N	%
Tumor size		
<1 cm	4	28.6
1–3 cm	8	57.1
>3 cm	2	14.3
Total	14	100
Mean tumor size	1.7 ± 0.4 cm	
Distance from tumor to nipple		
<2 cm	2	14.3
>2 cm	12	85.7
Total	14	100
Hormone receptor status		
ER positive	12	85.7
ER negative	2	14.3
PR positive	11	78.6
PR negative	3	21.4
HER2/neu positive	1	7.1
HER2/neu negative	13	92.9
Ki67 <20%	9	64.3
Ki67 >20%	5	35.7
Histological grade		
Grade I	4	28.6
Grade II	8	57.1
Grade III	0	0
Unclassified	2	14.3

As presented in Table 2, the mean tumor size was 1.7 ± 0.4 cm, and most tumors measured between 1 and 3 cm (57.1%). Only 14.3% of tumors were larger than 3 cm. The majority of patients belonged to the T1 stage group (85.7%). The tumor-to-nipple distance was >2 cm in 85.7% of cases, supporting the oncologic suitability for nipple-sparing surgery. Regarding immunohistochemical characteristics, ER positivity was observed in 85.7% of patients, while PR positivity accounted for 78.6%. HER2/neu overexpression was identified in only one patient (7.1%). Most tumors demonstrated low proliferative activity, with Ki67 <20% in 64.3% of cases. Histological grade II was the predominant subtype, accounting for 57.1% of tumors, whereas no patients were classified as grade III.

Table 3. Surgical Outcomes

Parameters	MIN	MAX	Mean
Operative time (minutes)	140	310	250.5 ± 23.3
Intraoperative blood loss (mL)	25	45	32.2 ± 5.6
Breast volume	120	250	200 ± 31.4

Parameters	MIN	MAX	Mean
Scar length (cm)	3.5	5	3.8 ± 0.7
Duration of postoperative analgesic use (days)	2	3	2.33 ± 0.5
Drain removal time (days)	6	9	7.2 ± 1.1
Postoperative hospital stay (days)	7	12	8.55 ± 0.6

Table 3 demonstrates that the mean operative time was 250.5 ± 23.3 minutes. The average intraoperative blood loss was low, at 32.2 ± 5.6 mL, and no patients required conversion to open surgery. The mean breast volume was 200 ± 31.4 mL. The average scar length was only 3.8 ± 0.7 cm, reflecting the minimally invasive nature of the single-port technique. Patients required postoperative analgesics for a mean duration of 2.33 ± 0.5 days. The mean drain removal time was 7.2 ± 1.1 days, while the average postoperative hospital stay was 8.55 ± 0.6 days.

Table 4. Intraoperative and Postoperative Complications

Complications	n	%
Total nipple necrosis	0	0
Partial nipple necrosis	1	7.5
Seroma	2	15
Infection	1	7.5
Bleeding	0	0
Skin flap ischemia	0	0
Skin flap necrosis	0	0
Implant pocket deformity	0	0

As shown in Table 4, the most common early postoperative complication was seroma formation, occurring in 15% of patients. Partial nipple necrosis and postoperative infection were each observed in one patient (7.5%). No cases of total nipple necrosis, postoperative bleeding, skin flap ischemia, skin flap necrosis, or implant pocket deformity were recorded. Overall, the complication profile suggested that the procedure was relatively safe and associated with acceptable early morbidity.

Table 5. Cosmetic Outcomes

Evaluation Time	n	%
After 1 week		
Excellent	9	62.3
Good	5	37.7
Fair	0	0
Poor	0	0
After 3 months		
Excellent	11	78.6
Good	3	21.4
Fair	0	0
Poor	0	0

According to the Lowery-Carlson cosmetic scale, Table 5 shows that 62.3% of patients achieved excellent cosmetic outcomes one week after surgery, while 37.7% achieved good outcomes. At the 3-month follow-up, the proportion of excellent cosmetic results increased to 78.6%. No cases of implant displacement or capsular contracture were observed during the follow-up period, indicating favorable short-term reconstructive outcomes.

Table 6. Quality of Life Assessment

Evaluation Time	Postoperative Reconstruction Group	Preoperative (Risk of Total Mastectomy)	p
Breast satisfaction	82.22 ± 5.22	56.28 ± 5.12	<0.01
Psychosocial well-being	79.75 ± 12.77	51.48 ± 3.70	<0.01
Sexual well-being	68.25 ± 6.86	51.90 ± 6.24	<0.01
Physical chest well-being	69.96 ± 9.56	53.03 ± 7.99	<0.01

As demonstrated in Table 6, Breast-Q scores improved significantly after surgery across all evaluated domains. Breast satisfaction scores increased from 56.28 ± 5.12 preoperatively to 82.22 ± 5.22 after reconstruction. Significant improvements were also observed in psychosocial well-being, sexual well-being, and physical chest well-being, with all comparisons showing statistical significance (P <0.01). These findings suggest that immediate implant-based reconstruction following single-port endoscopic nipple-sparing mastectomy may substantially improve postoperative quality of life in patients with early-stage breast cancer.

4. DISCUSSION

In the present study, most tumors were early-stage lesions with a mean tumor size of 1.7 ± 0.4 cm. Histological grade II was the predominant subtype, accounting for 57.1% of cases, while ER positivity and PR positivity were identified in 85.7% and 78.6% of patients, respectively. HER2 positivity was relatively low at 7.1%. These findings are consistent with previous studies reporting that minimally invasive nipple-sparing mastectomy is most commonly indicated for selected patients with early-stage tumors and favorable tumor biology [2, 6]. The predominance of hormone receptor–positive tumors in our study may partly explain the favorable short-term oncologic and reconstructive outcomes observed.

The operative outcomes in our study were comparable with previously published single-port endoscopic NSM series. The mean operative time was 250.5 ± 23.3 minutes, which falls within the range reported in international studies of minimally invasive nipple-sparing mastectomy [3, 7]. Although operative time may be longer than that of conventional open mastectomy because of the technical complexity and learning curve associated with endoscopic procedures, the mean intraoperative blood loss in our study remained very low at 32.2 ± 5.6 mL. Furthermore, no patients required conversion to open surgery, supporting the technical feasibility and safety of the single-port approach in carefully selected patients.

The minimally invasive nature of the procedure was also reflected in postoperative recovery outcomes. The mean

postoperative hospital stay was 8.55 ± 0.6 days, and the average surgical scar length was only 3.8 ± 0.7 cm. Concealing the incision within the axillary region may contribute to improved cosmetic appearance and reduced psychological burden associated with visible breast scars. Previous studies have emphasized that single-port endoscopic NSM provides superior scar concealment and less tension on the nipple–areolar complex compared with conventional approaches, thereby potentially reducing wound-related complications and improving patient satisfaction [1, 8].

Early postoperative complications in our study were uncommon and generally manageable. Seroma formation was the most frequent complication, occurring in 15% of patients, while partial nipple necrosis and surgical site infection each occurred in 7.5% of cases. Importantly, no patients developed total nipple necrosis, skin flap necrosis, postoperative bleeding, or implant deformity. These findings are comparable to previously published complication rates in minimally invasive NSM and implant-based reconstruction, where seroma rates range from approximately 6% to 18% and partial nipple ischemia or necrosis rates range from 3% to 10% [4, 9]. The absence of total nipple necrosis and implant loss in our series further supports the safety of this technique when appropriate patient selection and meticulous surgical technique are applied.

Cosmetic outcomes in our study were highly favorable. According to the Lowery-Carlson scale, 78.6% of patients achieved excellent cosmetic results after 3 months, and no cases of implant displacement or capsular contracture were observed during follow-up. Previous studies have consistently demonstrated that minimally invasive NSM with immediate implant-based reconstruction is associated with high aesthetic satisfaction because the breast skin envelope and nipple–areolar complex are preserved while scars remain hidden within the axillary region [2, 3]. These advantages may contribute substantially to improved body image and postoperative confidence among breast cancer patients.

In addition to favorable cosmetic outcomes, significant improvements were observed across all BREAST-Q quality-of-life domains, including breast satisfaction, psychosocial well-being, sexual well-being, and physical chest well-being ($P < 0.01$). These findings are consistent with previous studies demonstrating that nipple-sparing procedures and immediate breast reconstruction are associated with superior patient-reported outcomes compared with non–nipple-sparing or delayed reconstructive approaches [10]. Preservation of the native breast contour and nipple–areolar complex may help reduce the psychological impact of mastectomy and improve long-term quality of life. Overall, our findings support the feasibility, safety, and favorable patient-reported outcomes of single-port endoscopic nipple-sparing mastectomy with immediate implant-based reconstruction in selected patients with early-stage breast cancer.

5. CONCLUSION

Single-port endoscopic nipple-sparing mastectomy combined with immediate implant-based reconstruction is a feasible and safe approach for selected patients with early-stage breast cancer. The technique was associated with low blood loss, acceptable complication rates, favorable cosmetic outcomes, and significant improvements in postoperative quality of life, supporting its potential role as an effective minimally invasive breast surgical procedure.

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