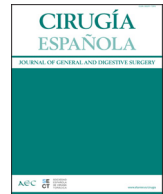




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Original article

Healthcare impact and surgical safety of endoscopic mastectomy in women with breast cancer or high-risk. Preliminary outcomes from the VideoBreast-24 trial

Impacto asistencial y seguridad quirúrgica de la mastectomía endoscópica en mujeres con cáncer de mama y de alto riesgo. Resultados preliminares del estudio VideoBreast-24

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ABSTRACT

Introduction: Skin and nipple-sparing mastectomy (NSSM) with immediate reconstruction has become the standard treatment for women requiring a mastectomy. The objective of this article is to describe endoscopic mastectomy (E-NSSM) and analyze the initial results after its implementation in terms of care impact and post-surgical complications.

Patient and methods: Preliminary results of the VideoBreast-24 in terms of safety and feasibility of the technique. VideoBreast-24 is a non-inferiority study that compares MPPP-E with immediate reconstruction with a polyurethane implant versus skin-sparing or skin-and-nipple mastectomy using the open technique (O-NSSM) performed within the framework of the PreQ-20 study.

Results: 60 E-NSSM were performed on 42 women, 92.9% of whom were oncological patients. The average surgery time was 213.7 min. The average implant volume is 322cc, with the largest volume being 545cc. There were no implant losses.

Conclusions: Endoscopic mastectomy is a technique with a low incidence of postoperative complications, surgical reintervention and readmission. Surgical time is longer than that of open mastectomy, although it can be optimized once the learning curve has passed.

RESUMEN

Introducción: La mastectomía preservadora de piel y pezón (MPPP) con reconstrucción inmediata se ha convertido en el tratamiento estándar tanto para mujeres que precisan una mastectomía. El objetivo de este artículo es describir la MPPP asistida por endoscopia (MPPP-E) y analizar los resultados iniciales tras su implantación en términos de impacto asistencial y complicaciones postquirúrgicas.

Paciente y métodos: Resultados preliminares del VideoBreast-24 en términos de seguridad y factibilidad de la técnica. VideoBreast-24 es un estudio de no inferioridad que compara la MPPP-E con reconstrucción inmediata con implante de poliuretano frente a la mastectomía preservadora de piel o piel y pezón mediante técnica abierta (MPPP-A) realizadas en el marco del estudio PreQ-20.

Resultados: Se realizaron 60 MPPP-E en 42 mujeres, siendo el 92,9% de las pacientes oncológicas. El tiempo medio de la cirugía fue de 213,7 minutos. El volumen medio de implante de 322cc, siendo el de mayor volumen de 545cc. No hubo pérdidas de implante.

Conclusiones: La MPPP-E es una técnica con baja incidencia de complicaciones postoperatorias, de reintervención quirúrgica y de reingreso. El tiempo quirúrgico es superior al de la mastectomía abierta si bien puede optimizarse una vez pasada la curva de aprendizaje.

Palabras clave:

Mastectomía endoscópica
Reconstrucción prepectoral
Mastectomías ultrapreservadoras

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Introduction

In recent years, NSSM with immediate reconstruction has become the standard treatment for both women with non-cutaneous breast cancer requiring mastectomy and women with high-risk breast cancer syndrome.^{1,2} Currently, there are no published randomised clinical trials comparing NSSM with radical mastectomy. However, several studies have shown a low incidence of local recurrence and a 5-year disease-free survival rate similar to that observed with radical mastectomy.^{3,4} The authors of these publications and the NCCN clinical guidelines⁵ conclude that a preoperative assessment should be performed for appropriate patient selection and that the procedure should be performed correctly by experienced surgeons.

The main limitation of NSSM is access to the medial quadrants due to their distance from the surgical incision. Therefore, in recent decades, several groups have incorporated endoscopic and/or robotic assistance into this procedure, facilitating dissection in these low-visibility areas.^{6–10} However, this procedure has some limitations that have delayed its implementation. The first is the technical difficulty, requiring the surgical team to have extensive experience in both breast surgery and endoscopic surgery. Other limitations include increased surgical time and the cost of the procedure.⁸ Combining direct access with endoscopic assistance combines the advantages of both methods, facilitating open dissection in the lateral quadrant and endoscopic dissection in the medial quadrants, thus optimising surgical time.

The objective of this article is to describe NSSM and analyse the initial results after its implementation in terms of clinical impact and postoperative complications.

Patients and method

This article presents the preliminary results of VideoBreast-24,¹¹ in terms of the safety and feasibility of the technique. VideoBreast-24 is a prospective, observational, non-inferiority study comparing E-NSSM with immediate reconstruction using a polyurethane implant versus O-NSSM performed within the framework of the PreQ-20 study (CEI 2020/295).² This study was reviewed and approved by the hospital's clinical ethics committee with reference number 2024/456 and was registered on the ClinicalTrials.gov website with code NCT06823414.¹²

Inclusion criteria. All women over 18 years of age diagnosed with breast cancer or high-risk breast cancer syndrome who underwent surgery between March 2024 and September 2025 were included. These women underwent unilateral or bilateral NSSM and immediate prepectoral reconstruction using a polyurethane implant. All surgeries were performed by two senior general surgeons specialising exclusively in breast pathology.

Exclusion criteria: Exclusion criteria¹³ were excluded.

Mastectomy and reconstruction technique

- 1 Patient positioning.** The patient is placed in the supine position with a pad under the back of the chest to allow anterior projection of the breasts. The arms are positioned at the sides of the torso with slight abduction (15°) and elbow flexion, and the hands secured to the pubis. Head stabilisation is necessary to allow the patient to sit up during reconstruction.
- 2 Incision.** A 4 cm incision is made in the lateral extension of the inframammary fold. Once the mastectomy is complete, this incision may be enlarged by 1–2 cm to accommodate the removal of large specimens and/or the handling of large-volume implants
- 3 Dissection of the retromammary space.** Dissection of the retromammary space. Using electrocautery with suction under direct

vision, the retromammary space is dissected, separating the mammary gland from the pectoralis major muscle.

- 4 Dissection of the lateral mammary fold.** Subcutaneous dissection of the outer quadrants of the gland is performed under direct vision. This dissection is extended as far as is safely visualised.
- 5 Device placement.** The single-port device is placed in the incision using three 10 mm trocars or two 10 mm trocars and one 12 mm trocar.
- 6 Gas insufflation.** CO₂ is insufflated through one of the ports of the single-port device at a pressure of 5–7 mmHg and a high flow rate (20 litres/minute).
- 7 Endoscopic mastectomy.** Using a 10 mm, 30° camera, a traumatic or atraumatic forceps (depending on the surgeon's preference), and a monopolar hook, the mastectomy is completed, respecting the subcutaneous fat and the anatomical boundaries of the gland. The dissection progresses through the area of best visualisation, and the surgeon must mobilise the gland as needed. During the dissection of the retroareolar tissue, a small pad of mammary gland tissue is preserved beneath the areola.
- 8 Device extraction.** Once the mastectomy is complete, the device is removed, and the surgical specimen is extracted and marked according to each centre's protocol.
- 9 Retroareolar Tissue Cleaning.** Retroareolar Tissue Cleaning.¹⁴ In cancer patients, an intraoperative biopsy of the nipple base is also performed. If affected, the sentinel lymph node(s) are removed during the surgical procedure.
- 10 Axillary staging.** Through the same incision, the axillary fat is accessed to identify and remove the sentinel lymph node(s).
- 11 Drain placement.** A redon suction drain is placed in the anterior axillary line.
- 12 Implant sizer and fit.** The implant sizer is placed to select the appropriate size for the patient. Finally, a silicone implant coated with polyurethane foam (Microthane™, POLYTECH Health & Aesthetics, Dieburg, Germany) is placed in the prepectoral position.
- 13 Wound closure.** Closure begins with a 4–0 absorbable monofilament suture in the subcutaneous tissue, followed by a subdermal layer with the same suture. Finally, a 5–0 absorbable monofilament intra-dermal suture is placed.

Perioperative care. Perioperative care¹⁵ and was sized according to each patient's specific anatomy and tumour location. Two grams of Cefazolin was administered intravenously before the start of the procedure. Subsequently, 1 gram of cefazolin was administered every 8 h for the first 24 h after the procedure. All patients were hospitalised for at least 24 h. The day after surgery, the absence of haematoma was confirmed, and the use of a T-shirt was recommended without the need for a compression bra. No patient received oral antibiotics at home. Patients were evaluated weekly during the first month for the early detection of complications. The suction drain was removed when its output was less than 40 mL/day.

Complementary treatments. Complementary treatments.⁵ Patients with tumours larger than 4 cm and/or lymph node involvement received radiotherapy to the chest wall and/or lymph node chains. Patients with microscopic involvement of the superficial mastectomy margin were evaluated by the committee for subcutaneous tissue extension or radiotherapy.

Definition of complications.

- Postsurgical bleeding. The appearance of any amount of blood during the first seven postoperative days that modifies the hospital admission (prolonging the stay or requiring reoperation).
- Seroma. Accumulation of periprosthetic fluid that requires maintaining drainage for more than 10 days or necessitates the placement of a new drain.
- Infection. The need for antibiotics in the first 30 postoperative days,

excluding antibiotic prophylaxis.

- Wound dehiscence. Separation of the edges of a surgical wound that requires intervention by the surgeon.
- Skin necrosis. The appearance of areas of skin without vascularisation that leads to cell death. This includes all necrosis that appears during the first 3 months after surgery and that requires intervention (appointment in the clinic or operating room).
- Implant loss. The need to remove the prosthesis for any reason.

Results

Between March 2024 and September 2025, 60 E-NSSM procedures were performed in 42 women. 92.9% of the patients underwent surgery for breast carcinoma, while 3 women (7.1%) presented with a high-risk syndrome for breast cancer. The main cause of bilateral mastectomy was cancer associated with a genetic mutation, with BRCA1 mutations being the most frequent (9.5%) (Table 1). The mean age of the patients was 47 years (range: 21–67 years), and 73.8% were premenopausal. The mean BMI was 24.9 kg/m², and the mean subcutaneous tissue thickness measured on mammography was 1.1 cm.

The most frequent tumour type was invasive ductal carcinoma (76.2%), and the most frequent subtype was Luminal B HER2- (26.2%). Half (50%) of the women had T1 tumours, 33.3% presented with lymph node involvement, and 33.3% and 14.3% presented with multifocal or multicentric disease, respectively. In 13 patients, superficial contact was observed in the mastectomy specimen. In 6 of these, intraoperative extension was performed, in 4 patients, delayed extension, and in the remaining 3 patients, radiotherapy to the abdominal wall was indicated due to the impossibility of extending the superficial margin (Table 2).

The mean time in surgery was 213.7 min, being significantly shorter in unilateral mastectomies (197.5 ± 44.1 vs. 235.9 ± 58.1; *p* = .023). From the 11th procedure onward, the surgical time for bilateral mastectomies stabilised. The time in surgery for unilateral mastectomies was variable over time (Fig. 1). Ninety-two point nine per cent of patients were admitted overnight. The remaining 3 patients were admitted for 2 nights, two due to a bilateral salpingo-oophorectomy and one for monitoring of self-limiting postoperative bleeding, which did not require reoperation (Table 3). The mean weight of the excised breast was 173.5 grams and the mean implant volume was 322 cc, with 61.9% of implants between 300 cc and 400 cc and the largest volume being 545 cc (Table 2, Fig. 2). Intraoperative complications occurred in 11 patients. One patient experienced axillary bleeding during the sentinel lymph node biopsy, requiring a separate axillary incision for its management. Incidental thermal skin injury occurred in 5 mastectomies (8.3%), one of which was due to tumour infiltration. Breast bleeding occurred in 5 women, leading to conversion to open surgery in one of them (Table 3).

During the postoperative period, nine mastectomies presented complications: two skin ecchymoses, four superficial nipple necrosis, one bleeding, and two superficial wound dehiscences. No patient experienced infection, readmission, reoperation for complications, or implant loss (Table 3). Fifty-seven point one per cent of the women received systemic treatment, most of them adjuvant therapy (38.1%), and 52.4% were prescribed chest wall radiotherapy (Table 4).

Discussion

Immediate prepectoral reconstruction after an NSSM is the technique of choice in women undergoing mastectomy due to its low morbidity, adequate oncological safety, and good cosmetic results.^{1,2} This procedure can be performed with endoscopic assistance, allowing for minimal incisions in areas of low visibility

Table 1

Clinical and pathological patient characteristics.

	Patients N = 42
Justification for Mastectomy	
Breast Carcinoma	39 (92.9%)
Risk Reduction	3 (7.1%)
Justification for Bilateral Mastectomy	
Bilateral Cancer	3 (7.1%)
Cancer and Mutation	7 (16.7%)
Cancer and High Risk, No Known Mutation	5 (11.9%)
Genetic Mutation without Cancer	3 (7.7%) (17.6%)
Age (years; mean and range)	46.6 ± 10.6 (R:21–67)
Weight (Kg)	66.1 ± 9.4 (R:50 – 94)
BMI (kg/m ²)	24.9 ± 3.4 (R:19.7–32.1)
Mean Subcutaneous Thickness (cm)	1.1 ± 0.5
Subcutaneous Thickness (Rancati classification)	
< 1 cm	19 (45.2%)
1–3 cm	23 (54.8%)
> 3 cm	0 (.0%)
Genetic mutation	
BRCA1	4 (9.5%)
BRCA2	3 (7.1%)
PALB2	1 (2.3%)
CHEK2	1 (2.3%)
Negative Full Panel	5 (11.9%)
Study Pending	16 (38.1%)
Not Requested	12 (30.8%)
Tumour Type	
Disseminated C-C-I	3 (7.1%)
Inflammatory C-C-I	32 (76.2%)
Inflammatory C-C-I	3 (7.1%)
Papillary Carcinoma	1 (2.3%)
Not Cancer	3 (7.1%)
Dissemination of Disease	
Unifocal	19 (45.2%)
Multifocal	14 (33.3%)
Multicentre	6 (14.3%)
Not Cancer	3 (7.1%)
Tumour Subtype	
Luminal A	12 (28.6%)
Luminal B Her2-	11 (26.2%)
Luminal B Her2 +	5 (11.9%)
Her2 +	3 (7.1%)
Triple negative	5 (11.9%)
Not cancer	6 (14.3%)
Tumour size (cm)	1.9 ± 1.6 (R: 0–5.5)
Tumour size (T)	
Tx (Neoadjuvant Therapy)	3 (7.1%)
Tis	3 (7.1%)
T1a	6 (14.3%)
T1b	5 (11.9%)
T1c	10 (23.8%)
T2	2 (4.8%)
T3	1 (2.3%)
Not cancer	3 (7.1%)
Lymph Node Stage	
Not evaluable	3 (7.1%)
Negative	25 (59.5%)
Positive	14 (33.3%)
Lymph Node Stage (N)	
Nx	3 (7.1%)
N0	25 (59.5%)
N1	13 (30.9%)
N2	1 (2.3%)
N3	0 (.0%)

and better visualisation for dissection of the inner quadrants.^{7,8} These techniques have become more popular in recent years, but their implementation has been limited due to the lack of prospective studies with long-term follow-up, the high cost of endoscopic/robotic equipment, and the increased surgical time.

The E-NSSM technique described in this study differs in some aspects from those described by other authors.^{16–18} First, positioning the upper limbs close to the trunk protects the brachial plexus from injury due to hyperextension of the arm. Furthermore, this position

Table 2
Surgical procedure characteristics.

	Patients N = 42
Procedure type	
Unilateral	24 (57.1%)
Bilateral	18 (43.9%)
Type of Axillary Surgery	
None	3 (7.1%)
Sentinel Lymph Node	38 (90.5%)
Lymphadenectomy	1 (2.3%)
Time in surgery (minutes)	
Total	213.7 ± 53.3 (120–360)
Unilateral	197.5 ± 44.1 (120–300)
Bilateral	235.9 ± 58.1 (180–360)
Hospital stay	
Mean	1.07 ± .3
1 night	39 (92.9%)
2 nights	3 (7.1%)
Surgical Specimen Weight (Breast)	173.5 ± 70.3 (50–380)
Implant volume (cc)	322.3 ± 89.1 (180–545)
Implant volume (cc)	
100–200	1 (2.3%)
201–300	23 (54.8%)
301–400	26 (61.9%)
401–500	6 (14.3%)
> 500	4 (9.5%)
Special situations	
Irradiated breast	1 (2.3%)
Reduction pattern	2 (4.6%)
Tumour-infiltrated skin	1 (2.3%)
Margins	
< 1 mm	7 (16.7%)
Contact	13 (30.9%)
Nipple involvement	1 (2.3%)
Margin extension*	
Intraoperative	6 (14.3%)
Delayed	4 (9.5%)

* Counted per breast cancer patient.

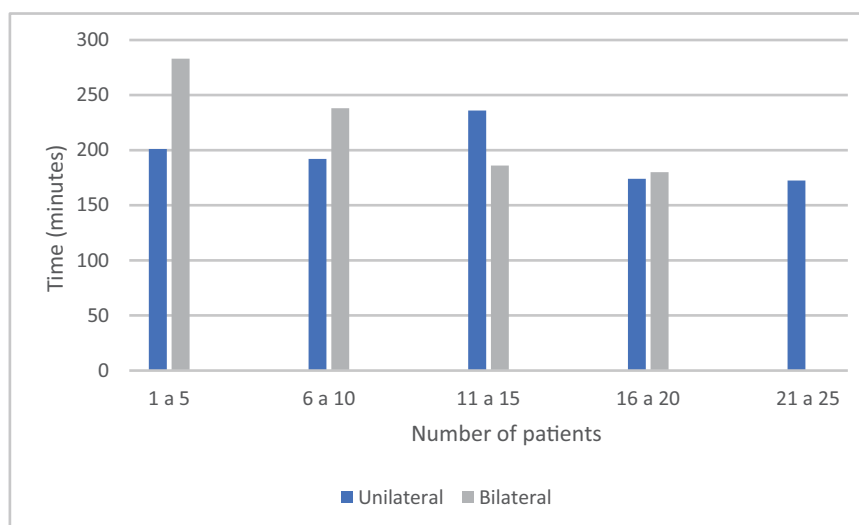
facilitates the movement of endoscopic instruments during dissection of the lower quadrants. Secondly, the inframammary fold incision is a low-visibility access point that contributes to a good cosmetic result, even when this incision is enlarged to remove the specimen and/or place the implant. The third advantage relates to the dissection method, which is performed with monopolar energy. This facilitates CO₂ dispersion in the subcutaneous plane and allows for the preservation of a greater amount of subcutaneous fat. This methodology differs from most groups that use sealing instruments, infuse Klein's solution subcutaneously, and perform indiscriminate

Table 3
Complications.

	Mastectomies N = 60
Intraoperative Complications (related to the endoscopic technique)	
Axillary Bleeding	1 (1.7%)
Breast Bleeding	5 (8.3%)
Thermal Skin Injury	5 (8.3%)
Conversion to Open Surgery	2 (3.3%)
First Endoscopic Surgery	1 (1.7%)
Breast Bleeding 2	1 (1.7%)
Postoperative Complications	
Haematoma	2 (3.3%)
Seroma	0 (.0%)
Bleeding	1 (1.7%)
Superficial Nipple Necrosis	4 (6.7%)
Wound Dehiscence	2 (3.3%)
Infection	0 (.0%)
Implant Loss	0 (.0%)

tunnelling with scissors, which can inadvertently damage the subcutaneous vascularisation. Fourthly, the dissection is performed by continuously alternating between the subcutaneous and prepectoral planes, as the surgeon sees fit, unlike other authors who complete the dissection of each plane before moving to the next.^{6,7,9,10} This change of planes facilitates the progression of the dissection and allows for a comprehensive view from different perspectives, reducing the possibility of thermal injury to the skin. Fifth, the nipple-areola complex is dissected after specimen removal, allowing for optimal cleaning of the glandular tissue without thermal injury to the areola. Using this technique, the complication rate was similar to that of open breast mastectomies performed by the same group.² Finally, in the described method, each area of the breast is dissected through an exposure that allows for greater visibility and access. Thus, the dissection of the prepectoral plane and the lateral and inferior skin flaps is performed using an open technique, while the medial quadrants, which are difficult to access through an incision in the inframammary fold, are approached endoscopically. This combination of open and endoscopic techniques facilitates optimisation of surgical time.

The main limitations in the implementation of endoscopic mastectomy have been the increased surgical time, the longer hospital stay, and the learning curve required to reduce these factors. In the present study, the mean surgical time for a unilateral E-NSSM was 189 min, longer than the time for open mastectomy (138 min),² and shorter than the mean time reported by most groups performing

**Fig. 1.** Time in surgery - Learning curve.

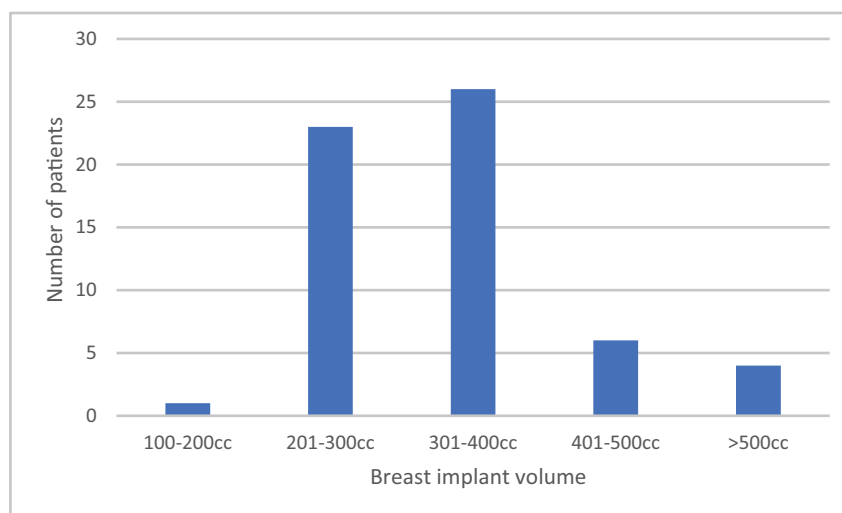


Fig. 2. Breast implant volume.

Table 4
Complementary treatments.

	Patients N = 42
Genomic Platform	
Oncotype	5 (11.9%)
Mamaprint	1 (2.3%)
Chemotherapy	24 (57.1%)
Neoadjuvant	8 (19.0%)
Adjuvant	16 (38.1%)
Anti-HER2 Therapy	8 (19.0%)
Radiotherapy	
Chest Wall and	22 (52.4%)
Lymph Node Chains	13 (31.0%)
Hormone Therapy	29 (69.0%)

E-NSSM (234–282 min, 8,9,15,16). Lai et al.¹⁸ performed a hybrid approach through an axillary incision without gas insufflation and reported a mean surgical time shorter than that of endoscopic mastectomy and slightly longer than that of the present study (210.1 min). In the present study, bilateral mastectomy was performed by two simultaneous surgical teams during the open surgery phase, followed by lymph node staging in the oncological breast while the opposing team performed the endoscopic phase. This strategy reduced the surgical time and brought it in line with the times for open bilateral E-NSSM described in the PreQ-20 study.² In the experience of Yang et al.,¹⁶ the mean operative time stabilised at approximately 172.55 min after 18 cases. This figure was higher than the learning curve for both the open and robotic techniques, with the latter improving from the 10th procedure onward and stabilizing by the 19th.¹⁸ In the present study, starting with patient number 11, the time for bilateral mastectomy stabilized at 180 min. The average stay in the present study was 1 day, which is shorter than that of the P-NSSM patients in the PreQ-20 study² and much shorter than the 5–6 days described by other groups performing endoscopic surgery.^{16,18}

The clinical context of this study is primarily oncological (92.9%). This scenario is more complex than that of risk-reducing mastectomy, as it requires planning and technical execution that ensures adequate disease removal and tumour-free margins. The main challenge of endoscopic NSSM in an oncological breast is the ease with which tumour landmarks can be lost, especially due to the absence of tumour palpation during the endoscopic phase. However, although there is no direct contact with the tumour, an experienced surgeon can develop haptic sensation, allowing them to perceive the consistency and resistance of the tissues through the instruments. Another challenge

inherent to ultra-conserving mastectomies, and therefore shared with O-NSSM, is the superficial margin of the mastectomy specimen. Therefore, its evaluation is necessary to rule out involvement of this margin, which, if present, may require an extension or the indication of adjuvant radiotherapy. Finally, another added difficulty is the fragmentation of the surgical specimen during its extraction through the wound, which leads to an inadequate assessment of the superficial margin. For this reason, it is important to consider enlarging the surgical wound in cases where extraction of the mastectomy specimen is difficult, either due to its size or the presence of dense glandular tissue.

This initial experience has also allowed us to explore other previously non-described indications, such as irradiated breasts, tumours close to the skin, or breasts requiring minimal skin reduction. This latter scenario is possible in patients with breasts exhibiting mild-to-moderate atypia who are candidates for mastectomy with skin and superior pedicle reduction. The experience in this study is limited (2 patients), but it has confirmed the technical feasibility of this approach through de-epithelialisation of the pattern and preservation of the skin envelope.

This study has several limitations. First, the small sample size makes it difficult to analyze the incidence of rare complications such as infection or implant loss. Second, the short follow-up period does not allow for an analysis of the oncological safety of this technique in the medium and long term.

In conclusion, E-NSSM is a safe technique with a low incidence of postoperative complications, surgical reintervention, and readmission. Most patients will only require one night's hospital stay thanks to their rapid postoperative recovery. Conversely, the surgical time is longer than that of open mastectomy, although it can be optimised once the learning curve has been overcome.

Ethical considerations

The hospital's protocols regarding ethical considerations in research were followed.

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Declaration of competing interest

The authors declare no conflict of interest.

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