Case Report

Eur J Breast Health
DOI: 10.4274/ejbh.galenos.2025.2024-12-4

Air-Assisted Mastectomy Using LigaSure for a Breast Cancer Patient with a Cardiac Pacemaker

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ABSTRACT

Mastectomy is often performed using unipolar electrocautery. However, for patients with a pacemaker, alternative methods are necessary, as the use of unipolar cautery is not recommended. In the case presented herein, we made half-centimeter incisions on the skin to be removed. We then pumped air under the mastectomy flaps through these incisions using a hand pump and a lipoplasty cannula equipped with a filter. Following this, we made a Stewart incision and conducted the dissection using a LigaSure vessel-sealing device from the plane formed by the air. The surgery was successfully completed without any significant bleeding, and the patient was discharged without any complications. Notably, this innovative surgical technique was employed for the first time in a breast cancer patient. The cannula we developed has facilitated the creation of a dissection plane using air, similar to endoscopic mastectomy, without requiring additional ports or equipment. This technique has the potential to facilitate surgery for selected patients.

Keywords: Mastectomy; air-assisted mastectomy; minimally invasive surgical procedures; breast cancer; pacemaker; BRCA mutation

Cite this article as: Tukenmez M, Mollavelioglu B, Emiroglu S, Cabioglu N, Muslumanoglu M, Ozmen V. Air-assisted mastectomy using LigaSure for a breast cancer patient with a cardiac pacemaker. Eur J Breast Health. [Epub Ahead of Print]

Key Point

- Novel surgical technique: Air-assisted mastectomy.

Introduction

Breast-conserving surgery (BCS) is the preferred approach in the surgical management of breast cancer; however, mastectomy remains essential for selected patients with high-risk features. Unipolar electrocautery is commonly used during mastectomy, but it is not suitable for patients with pacemakers (1). The aim of this report is to describe an air-assisted mastectomy technique in a case where bilateral mastectomy was required, but unipolar electrocautery could not be used due to the patient's complete complete atrioventricular (AV) block.

Case Presentation

In 1996, at the age of 31 years, the patient had BCS and axillary lymph node dissection (ALND) for a left breast tumor. The pathology report showed a T2N1 tumor (3.5 cm in size with 6 out of 28 metastatic lymph nodes). Adjuvant treatment included six cycles of endoxan + methotrexate + fluorouracil and radiotherapy to the left breast and regional lymphatics. In 2002, at the age of 37 years, a T1N0 medullary carcinoma was found in the right breast. The patient underwent BCS + ALND, and the pathological evaluation revealed a 1.5 cm triple-negative breast cancer with nine non-metastatic lymph nodes. Adjuvant treatment consisted of four cycles of adriamycin + cyclophosphamide and radiotherapy to the right breast. One year after chemotherapy, the patient developed complete AV block due to anthracycline toxicity, leading to the implantation of a cardiac pacemaker and an implantable cardioverter-defibrillator (ICD). In the course of the follow-up, a pathogenic mutation of *BRCA-1* was identified on genetic analysis. Subsequently, in the 27th year of follow-up, a 2 cm invasive carcinoma was detected in the retro-areolar region of the right breast. The multidisciplinary council advised upfront surgery in the form of a bilateral mastectomy. Given the patient's pre-existing comorbidities and the contraindication of unipolar electrocautery due to the presence of a pacemaker, a decision was made to employ the air-assisted technique, which had previously been described for the treatment of gynecomastia (2).

A standard horizontal elliptical incision encompassing the nipple was marked on both breasts. Half-centimeter incisions were made on the skin to be excised. Air was pumped under the mastectomy flaps through

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Received: 23.03.2025
Accepted: 04.08.2025
Epub: 18.08.2025

these incisions with a hand pump and a lipoplasty cannula with a filter (Figure 1, Video 1). Air insufflation into the subcutaneous tissue causes separation between the breast parenchyma and the overlying subcutaneous layer, making Cooper's ligaments more prominent. This phenomenon is referred to as pneumocooper. The pneumocooper, achieved by introducing air beneath the skin facilitated the creation of a space between the mammary gland and subcutaneous tissue. Then a further incision was made, and the dissection was carried out with a vessel-sealing device (LigaSure) from the plane between the subdermal layer and the glandular tissue formed by the air. Furthermore, a dissection plan was formulated, delineating the space between the breast tissue and the fascia of the pectoralis major muscle. This was achieved through the introduction of air from the lateral border of the pectoralis major muscle via the hand cannula. Deep plane dissection was efficiently completed using the vessel-sealing device. The same procedure was performed bilaterally and a chemotherapy port was inserted with its catheter advanced into the right subclavian vein. The operation was completed in 150 minutes. As a vessel sealing device was used throughout the procedure, intraoperative bleeding was significantly less than in conventional mastectomy. The estimated blood loss was approximately 30 mL.

The patient was discharged on the second postoperative day (Figure 2). No complications occurred during the postoperative period or throughout the six months of follow-up. Histopathological evaluation revealed two foci of invasive ductal carcinoma measuring 2 cm (triple negative) and 0.5 cm (luminal A) in the right breast, and ductal carcinoma *in situ* in the left breast. The sentinel lymph node biopsy on the right side showed three non-metastatic lymph nodes. The recommended treatment plan included adjuvant chemotherapy (taxane-based) and hormonotherapy. Informed consent was obtained from the patient included in the study.

Discussion and Conclusion

This is the first case report describing the use of air-assisted dissection with LigaSure in a breast cancer patient with a cardiac pacemaker, offering a unique alternative to unipolar cautery. The use of the Harmonic device in breast cancer patients with pacemakers has been reported previously (3, 4). In the present case LigaSure was used as a vessel-sealing device. In addition, the air-assisted technique was used to make the dissection faster, easier, and with less bleeding. The guidelines of the Heart Rhythm Society comment that unipolar electrocautery poses a significant risk of interference with pacemakers or defibrillators (1). While precautions such as magnet placement or reprogramming may be considered, the presence of an ICD in this patient rendered the use of unipolar cautery inadvisable, hence prompting the use of the LigaSure device.

The patient had a history of bilateral BCS for previous bilateral breast cancer. While recurrence was detected unilaterally on imaging, a bilateral mastectomy was deemed appropriate in light of the patient's

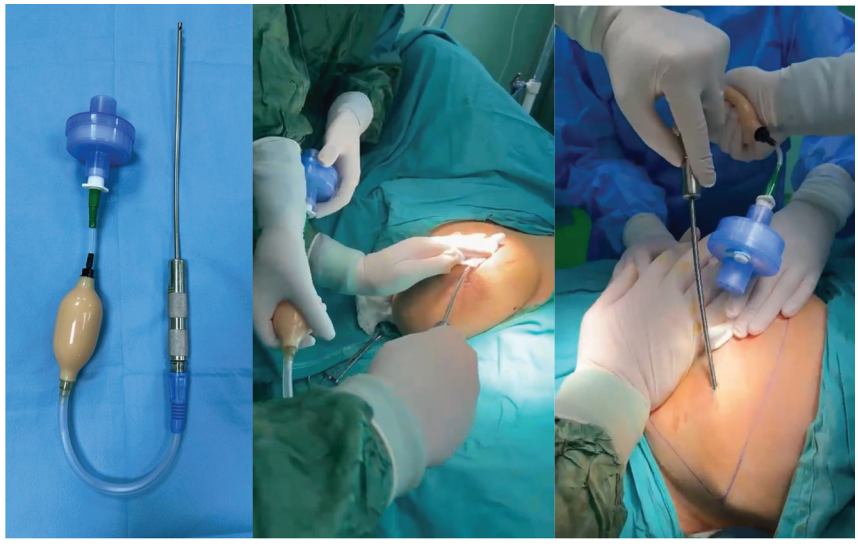

Figure 1. Hand pump and lipoplasty cannula with a filter and its application

Figure 2. Preoperative and postoperative images

BRCA1 mutation, high comorbidity burden, and limited tolerance for additional surgeries. While a second BCS may be considered in selected cases of recurrence (5), the patient's genetic background and comorbid profile made this option unsuitable.

Previous research suggested that in high-risk anesthesia patients, mastectomy may be performed using a subcutaneous tumescent solution (6). However, the tumescent technique can make dissection with bipolar cautery more challenging and there is evidence that skin necrosis rates may be higher (7). Unlike the tumescent solution, which may increase the risk of skin necrosis, an air-assisted dissection technique may offer a safer alternative by facilitating clearer dissection planes and reducing thermal injury, thereby potentially lowering skin-related morbidities. The Shaw scalpel has also been reported as a safe alternative in patients with pacemakers but it is not routinely used in our institution and would incur additional cost (8).

Our method involved using a hand pump to insufflate air into the subcutaneous area, creating a pneumocooper, which allowed for dissection without any bleeding through the use of the vessel-sealing device. Our team developed this specific cannula for this purpose, enabling us to expedite the dissection process in a similar fashion to the previously described endoscopic mastectomy technique without necessitating additional ports or equipment (9, 10). CO_2 insufflation has been shown to facilitate both dissection and the creation of a working space in minimally invasive breast surgery techniques, such as endoscopic and robotic mastectomy (11). In our technique, the key advantage of subcutaneous CO_2 insufflation was to enhance tissue separation and facilitate dissection with the vessel-sealing device. In our series of patients with gynecomastia, we used air-assisted surgery with the application of CO_2 subcutaneously using an insufflator. We observed that this technique makes dissection easier (2, 6). Although various approaches have been reported for patients with a pacemaker, this is the first report of using air-assisted dissection with LigaSure in a breast cancer patient with a pacemaker, providing a practical solution without requiring additional equipment (3, 8). We believe that this method will make surgery easier for selected patients. The disadvantages of our technique are that it is more costly than the standard surgical method and requires additional equipment.

The technique described in the present case report can be considered as an alternative, especially for patients for whom unipolar electrocautery is not a suitable option. Larger patient series are necessary to unequivocally demonstrate the safety and feasibility of this method.

Video 1. Pumping air under the mastectomy flaps

Ethics

Informed Consent: Informed consent was obtained from the patient included in the study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: M.T.; Concept: M.T., S.E., N.C., M.M., V.O.; Design: M.T., S.E., N.C., M.M., V.O.; Data Collection or Processing: B.M., S.E., N.C., M.M., V.O.; Analysis or Interpretation: M.T., B.M.; Literature Search: B.M.; Writing: M.T., B.M.

Conflict of Interest: Vahit Ozmen MD is editor-in-chief in European Journal of Breast Health. He had no involvement in the peer-review of this article and had no access to information regarding its peer-review.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Crossley GH, Poole JE, Rozner MA, Asirvatham SJ, Cheng A, Chung MK, et al. The Heart Rhythm Society (HRS)/American Society of Anesthesiologists (ASA) expert consensus statement on the perioperative management of patients with implantable defibrillators, pacemakers and arrhythmia monitors: facilities and patient management this document was developed as a joint project with the American Society of Anesthesiologists (ASA), and in collaboration with the American Heart Association (AHA), and the Society of Thoracic Surgeons (STS). Heart Rhythm. 2011; 8: 1114-1154. (PMID: 21722856) [Crossref]
2. Tukenmez M, Mollavelioglu B, Kozanoglu E, Emiroglu S, Cabioglu N, Muslumanoglu M. A novel surgical technique for gynecomastia: air-assisted minimally invasive surgery with single axillary incision. Surg Innov. 2024; 31: 5-10. (PMID: 37995296) [Crossref]
3. Poole G, Biggar M, Moss D. Use of the harmonic scalpel for breast surgery in patients with a cardiac pacemaker--a tip. Breast J. 2010; 16: 108-109. (PMID: 19968657) [Crossref]
4. Sabaretnam M, Mishra A. Utility of ultrasonic scalpel for axillary dissection in a patient with permanent cardiac pacemakers. Indian J Cancer. 2015; 52: 209. (PMID: 26853407) [Crossref]
5. Hannoun-Levi JM, Gal J, Van Limbergen E, Chand ME, Schiappa R, Smanyko V, et al. Salvage mastectomy versus second conservative treatment for second ipsilateral breast tumor event: a propensity score-matched cohort analysis of the GEC-ESTRO breast cancer working group database. Int J Radiat Oncol Biol Phys. 2021; 110: 452-461. (PMID: 33383125) [Crossref]
6. Carlson GW. Total mastectomy under local anesthesia: the tumescent technique. Breast J. 2005; 11: 100-102. (PMID: 15730454) [Crossref]
7. Siotos C, Aston JW, Euhus DM, Seal SM, Manahan MA, Rosson GD. The use of tumescent technique in mastectomy and related complications: a meta-analysis. Plast Reconstr Surg. 2019; 143: 39-48. (PMID: 30589774) [Crossref]
8. Tokumine J, Sugahara K, Matsuyama T, Nitta K, Fuchigami T, Miyaguni T. Shaw scalpel for breast mastectomy in a pacemaker-implanted patient. J Anesth. 2005; 19: 349. (PMID: 16261480) [Crossref]
9. Soybir G, Fukuma E. Endoscopy assisted oncoplastic breast surgery (EAOBS). J Breast Health. 2015; 11: 52-58. (PMID: 28331692) [Crossref]
10. Tukenmez M, Ozden BC, Agcaoglu O, Kecer M, Ozmen V, Muslumanoglu M, et al. Videoendoscopic single-port nipple-sparing mastectomy and immediate reconstruction. J Laparoendosc Adv Surg Tech A. 2014; 24: 77-82. (PMID: 24401140) [Crossref]
11. Mok CW, Lai HW. Evolution of minimal access breast surgery. Gland Surg. 2019; 8: 784-793. (PMID: 32042687) [Crossref]