World Cancer Research Journal
WCRJ 2023; 10: e2682
DOI: 10.32113/wcrj_20239_2682

BREAST CANCER TREATMENT DE-ESCALATION: BREAKING THE SOUND BARRIER

G. VANNI[1], M. MATERAZZO[1,2], M. PELLICCIARO[1,2], F. TACCONI[3], B.A. FACCINI[4], B. LONGO[1,5], V. CERVELLI[5], O.C. BUONOMO[1]

• • •

[1]Department of Surgical Science, Breast Unit, Tor Vergata University, Rome, Italy
[2]PhD Program in Applied Medical-Surgical Sciences, Breast Oncoplastic Surgery, University of Rome Tor Vergata, Rome, Italy
[3]Department of Surgical Science, Thoracic Surgery, Tor Vergata University, Rome, Italy
[4]Department of Precision Medicine, University of Study of Campania "L. Vanvitelli", Naples, Italy
[5]Department of Surgical Science, Plastic Surgery, Tor Vergata University, Rome, Italy

Corresponding Author
Marco Materazzo, PhD; e-mail: mrcmaterazzo@gmail.com

ABSTRACT – Breast Cancer (BC) is the leading oncological diagnosis, with the annual incidence expected to exceed 3 million new cases by 2040 due to population growth and ageing. Despite the increasing number of BC patients, recent advancements in multidisciplinary treatment have enabled surgical de-escalation, maintaining equivalent oncological outcomes. Areas of surgical de-escalation include avoidance of axillary lymph node dissection in patients with low disease burden, re-excision in close margins after breast conserving surgery, and even complete avoidance of surgery in selected cases. Despite the evidence supporting these de-escalation protocols, their implementation is inconsistent. The article discusses how these strategies can be further integrated into BC treatment plans to improve patients' quality of life and optimize health care resources. The future of BC management may be shaped by genomic tests, offering more tailored and potentially less invasive treatment strategies. A comprehensive understanding of tumor biology has facilitated the development of strategies such as neoadjuvant chemotherapy, with the potential to further de-escalate surgery. The need for a multidisciplinary approach to BC care, incorporating emerging diagnostic tools and understanding of individual patient's disease trajectory, is paramount. It is essential to challenge the perception of more aggressive treatments as inherently better and ensure decisions are based on high-quality evidence, preserving the principle of 'do no harm'. The focus of future BC research should be on identifying markers capable of predicting the risk of distant recurrence and implementing a true multidisciplinary de-escalation approach.

KEYWORDS: Breast Neoplasms, Quality of Life, Surgery, Mastectomy, Segmental, Precision medicine.

Breast Cancer (BC) is the primary oncological diagnosis with an annual incidence of more than 2 million patients diagnosed annually [1]. Because of population growth and aging, by 2040 the BC burden is expected to spread over 3 million new cases with 1 million death annually [2]. Despite the rising number of BC patients, in recent years multidisciplinary treatment has allowed safe surgical de-escalation while maintaining equivalent oncological outcomes. Current scientific evidence supports surgical de-escalation by avoiding axillary lymph node dissection (ALND) in patients with low disease burden in sentinel

lymph node (SLN)[3], re-excision in close margins after breast conserving surgery (BCS)[4]. Future areas of surgical de-escalation include SLN biopsy alone or with targeted axillary dissection (TAD) subsequent neoadjuvant chemotherapy (NAC), and avoidance of surgery in selected clinical settings (such as low risk ductal carcinoma in situ, complete response after NAC)[5]. Despite the presence of evidence supporting equivalent long-term oncological outcomes, the application of surgical protocols designed to minimize surgical trauma remains inconsistent. The aim of the present commentary is to delineate how surgical de-escalation may be incorporated into multidisciplinary treatment in breast cancer care.

Surgical procedures, which do not yield any oncological benefits with potential risk for patients, pose unnecessary long-term detrimental effects on patients' quality of life (QoL) and also may result in a misallocation of health care resources, further exacerbating inequalities among health care[6,7]. It has been estimated that in Italy over 800 000 women, a number equivalent to a city as large as Turin, deals every day with BC surgical treatment side effects with a possible detrimental effect on QoL[8-10].

Under this perspective, a surgeon's duty is to guide our patients and to mitigate their fear, demystifying their misconceptions to select together the most appropriate surgical procedure. In fact, while breast reconstructive strategies are equivalent in terms of breast appearance, in young women higher value were obtained in terms of satisfaction with breast, psychosocial well-being, and sexual well-being after BCS [11]. While this difference seems to be reduced after long term follow up, up to 17% women undergoing prophylactic bilateral mastectomy are neutral or dissatisfied about their surgical choice [12]. Without a clear benefit for the patients, the lack of implementation of de-escalation protocols could lead to multiple adverse effects. These include compromised patient QoL, increasing surgical complications, escalating healthcare and related costs, and even a rise in health care related environmental pollution [7,13].

Over the last two centuries, BC treatment was mostly entrusted to the surgeon, who offered the first effective treatment in 1894 by Halsted[14] (Figure 1). While in the first half of the century some authors tried to reduce the extent of surgery, only after the implementation of adjuvant treatments Fisher et al [15] and Veronesi et al [16] could design the first conserving treatment for BC, providing the first real de-escalation in surgery (minimum effective treatment) [15,16]. In fact, in their miliary stone studies, both authors obtained equivalent oncological outcomes due to the three core principles of breast cancer care: multidisciplinary treatment, centralization of care in breast cancer care facilities, and breast cancer treatment innovation. This was a significant step forward, showing that surgical de-escalation for the first time did not compromise patient survival.

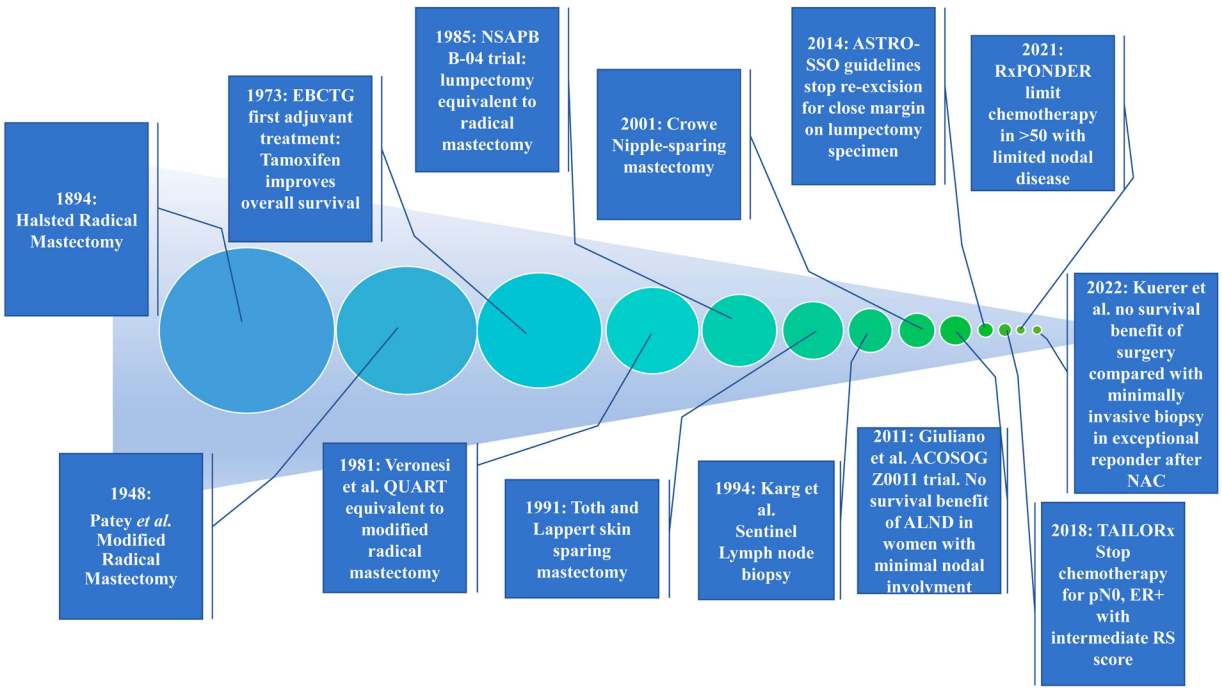

Figure 1. Timeline of milestone papers in breast surgical de-escalation. the size of the circle depicts the surgical invasiveness of the described procedure.

The 1990s saw further de-escalation with the introduction of sentinel lymph node (SLN) biopsy. SLN biopsy (SLB) replaced axillary lymph node dissection (ALND) for staging the axilla in patients with clinically node-negative BC. This significantly reduced the morbidity associated with ALND, particularly lymphedema and arm dysfunction, without impacting the oncological safety, providing equivalent oncological outcomes in breast cancer patients [17]. However, even if ALND competition was indicated in any SLN pathological involvement, indications for completion of axillary surgery have been progressively narrowed, as clinical benefits were not demonstrated for patients with micrometastases or isolated tumor cells [18]. This was a marked departure from previous standards, wherein axillary lymph node dissection (ALND) was routinely performed. Giuliano's study represented a significant revolution in axillary surgery. Despite its limitations, the study showed that in cases of limited axillary disease, ALND did not guarantee improved long-term survival outcomes [3]. The study conducted by Giuliano et al[3] marked a substantial shift in our understanding of the role of axillary surgery in breast cancer management. With increasingly effective integrated treatments, the role of axillary surgery has largely transitioned to a staging one, informing subsequent therapeutic decisions [19]. Genomic tests, which are already in use in clinical practice and have been widely validated by studies such as RxPONDER and TAILORx, could potentially supersede the staging role of axillary surgery in breast cancer. This, in conjunction with advanced radiology, could reshape our approach towards axillary management [20,21].

The promise of genomic tests lies in their capacity to provide a deeper understanding of the individual patient's tumor biology[22,23]. These tests can offer more precise prognostic information than traditional staging procedures, allowing for more tailored and potentially less invasive treatment strategies[24]. While this concept requires further investigation and validation, it points towards a future where breast cancer care could be even more personalized, effective, and less reliant on surgical intervention [13]. Under this perspective the results of the SOUND trial will provide primary information regarding oncological safety of surgical axillary avoidance[25,26]. However, even in anticipation of these results, steps have already been taken to reduce unnecessary axillary interventions. The Choosing Wisely initiative has highlighted the overuse of sentinel lymph node biopsy (SLNB) in patients for whom it would not significantly alter subsequent therapeutic choices [27]. In these cases, the results of SLNB would not change the prognosis and would only add an unnecessary surgical risk without clear benefits. This has further reinforced the shift towards less invasive axillary management strategies [27]. Therefore over recent years, surgery has evolved from a procedure with a significant impact on various aspects of quality of life to one that can be performed almost exclusively or entirely under local anesthesia [28-30].

Over time, a deeper understanding of tumor biology has enabled the development of multidisciplinary strategies such as neoadjuvant chemotherapy (NAC). This approach, where systemic therapy is given prior to definitive surgery, has been traditionally designed to reduce the extent of surgery and reoperation rate with conversion rate toward breast and axillary conserving surgery in up to the 40% of patients [31,32]. Additionally, a broader application of NAC in the BC population demonstrated how achieving a pathologic complete response (pCR) is associated with improved long-term outcomes, particularly in patients with aggressive tumor subtypes [33]. pCR or the absence of residual invasive cancer in the breast and axillary lymph nodes following neoadjuvant therapy is nowadays the primary aim, stratifying patients who could benefit more from further adjuvant regimen [34]. Recent years have seen an expansion in the use of neoadjuvant chemotherapy even in early-stage patients, especially in tumors with favorable biology for achieving pCR [35]. The COVID-19 pandemic also accelerated the adoption of NAC even in EBC. To reduce the risk of cross-infection during the pandemic, an increasing number of patients were directed to neoadjuvant therapy, leading to delayed surgeries, and minimized hospital exposure [36,37]. In the recent past, the increasing rate of pCR after NAC thanks to innovative therapy along with advances in imaging may lead to ultimate breast conservation with avoidance of surgery at the end of NAC. Preliminary results from Kuerer et al[38], suggests that with the expanded use of neoadjuvant chemotherapy and targeted therapies, along with advances in imaging, the future might hold a paradigm shift where surgery might no longer be required in managing breast cancer[5].

While scientific evidence over the past fifty years has enabled a safe de-escalation of breast surgery as shown in Figures 2 and 3, further efforts need to be made to promote a de-escalating multidisciplinary approach to BC. In fact integrate emerging diagnostic and predictive tools, and refine our understanding of individual patient's disease trajectory and response to treatment could eventually reduce the overtreatment and correct allocation of health care resources among patients[39]. Breast surgery, which was one of the first disciplines to initiate a path towards reducing the impact of treatment on patients' quality of life, should pave the way for all players involved in the multidisciplinary treatment of breast cancer to avoid overtreatment. This is particularly crucial in cases where patients undergo a less invasive procedure, perceived as less effective by other physicians with the consequent the paradoxical escalation

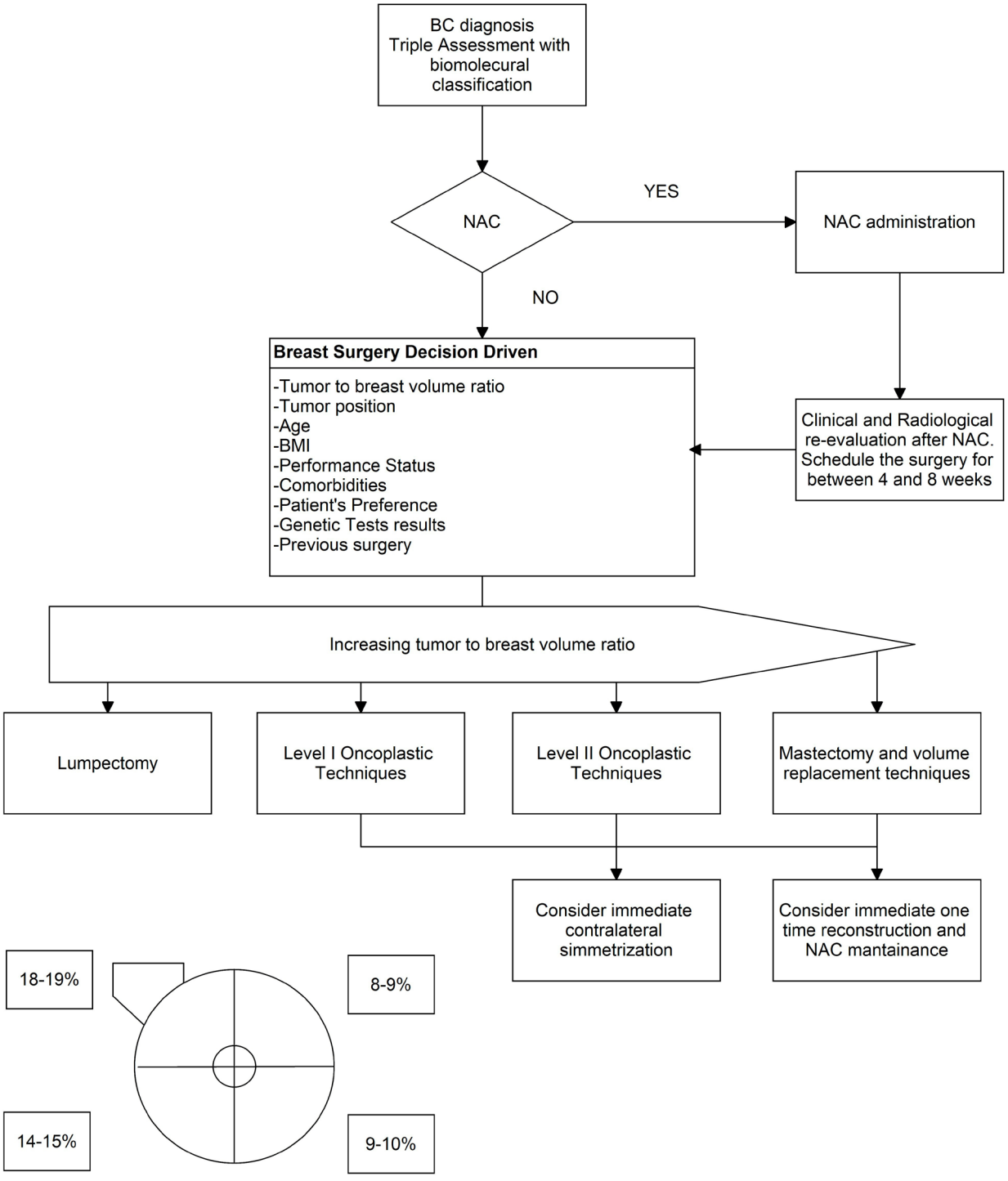

Figure 2. Primary surgery decision flowchart. In the bottom left the maximum percentages of breast volume that were resectable by conventional BCS without resulting in unacceptable aesthetic and functional outcomes or decreased quality of life according to Pukancsik et al[40]. *Abbreviations* - BC: Breast Cancer; NAC: Neoadjuvant Chemotherapy; BMI: Body Mass Index; NAC: Nipple Areola Complex.

of adjuvant treatment. It is essential to challenge this perception and ensure that decisions are informed by high-quality evidence, preserving the principle of 'do no harm.' More aggressive treatments should only be pursued when there is a clear, demonstrable benefit for the patient, and not simply based on unfounded beliefs or biases. The future of breast oncological research should focus less on striving for increasingly minimalistic surgery and more on the identification of markers capable of predicting the risk of distant recurrence with the ultimate goal of ensuring safe multidisciplinary de-escalation.

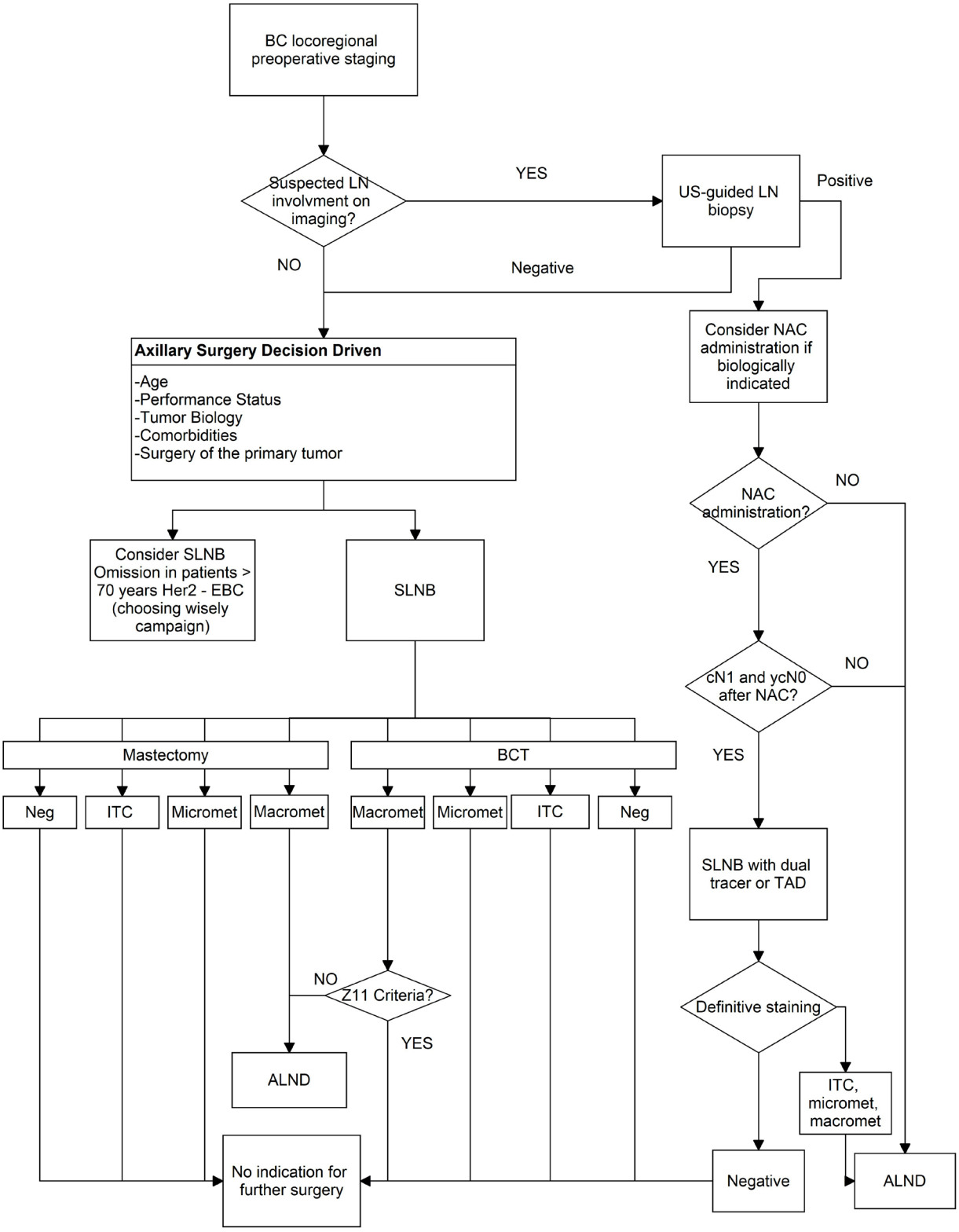

Figure 3. Axillary surgery decision flowchart. *Abbreviations* - BC: Breast Cancer; LN: Lymph node; US: Ultrasound; NAC: neoadjuvant chemotherapy; SLNB: Sentinel Lymph node biopsy; HR: hormone receptor; HER2: epidermal growth factor receptor 2; EBC: Early breast Cancer; ITC; Isolated Tumor Cells, ALND: Axillary Lymph node dissection; TAD: Target Axillary Dissection.

Financial support:
Not applicable

Ethics approval and consent to participate:
Not required

Conflict of interest:
The authors declare there is no conflict of interest in this case report.

Funding:
Not Applicable

Author contributions:
Conceptualization: Gianluca Vanni, Oreste Claudio Buonomo, Marco Materazzo; Methodology: Marco Pellicciaro, Bianca Arianna Faccini, Writing – Original Draft: Writing - Review & Editing: Marco Materazzo, Gianluca Vanni, Benedetto Longo, Federico Tacconi, Gianluca Vanni; Supervision: Oreste Claudio Buonomo, Valerio Cervelli.

ORCID ID:
Vanni Gianluca: https://orcid.org/0000-0002-3006-5855
Materazzo Marco: https://orcid.org/0000-0002-3599-061X
Pellicciaro Marco: https://orcid.org/0000-0001-9557-2850
Federico Tacconi: https://orcid.org/0000-0001-8850-5027
Benedetto Longo: https://orcid.org/0000-0001-8671-0609
Valerio Cervelli: https://orcid.org/0000-0001-8671-0609
Buonomo Oreste Claudio: https://orcid.org/0000-0002-9531-8737

REFERENCES

1. Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer statistics, 2022. CA Cancer J Clin 2022; 72: 7-33.
2. Arnold M, Morgan E, Rumgay H, Mafra A, Singh D, Laversanne M, Arnold M, Morgan E, Rumgay H, Mafra A, Singh D, Laversanne M, Vignat J, Gralow JR, Cardoso F, Siesling S, Soerjomataram I. Current and future burden of breast cancer: Global statistics for 2020 and 2040. Breast 2022; 66: 15-23.
3. Giuliano AE, Ballman K V., McCall L, Beitsch PD, Brennan MB, Kelemen PR, Ollila DW, Hansen NM, Whitworth PW, Blumencranz PW, Leitch AM, Saha S, Hunt KK, Morrow M. Effect of axillary dissection vs no axillary dissection on 10-year overall survival among women with invasive breast cancer and sentinel node metastasis: The ACOSOG Z0011 (Alliance) randomized clinical trial. JAMA 2017; 318: 918-926.
4. Moran MS, Schnitt SJ, Giuliano AE, Harris JR, Khan SA, Horton J, Klimberg S, Chavez-MacGregor M, Freedman G, Houssami N, Johnson PL, Morrow M. Society of Surgical Oncology-American Society for Radiation Oncology consensus guideline on margins for breast-conserving surgery with whole-breast irradiation in stages I and II invasive breast cancer. J Clin Oncol 2014; 32: 1507-1515.
5. Heil J, Kuerer HM, Pfob A, Rauch G, Sinn HP, Golatta M, Liefers GJ, Peeters MJV. Eliminating the breast cancer surgery paradigm after neoadjuvant systemic therapy: current evidence and future challenges. Ann Oncol 2020; 31: 61-71.
6. Shubeck SP, Morrow M, Dossett LA. De-escalation in breast cancer surgery. NPJ Breast Cancer 2022; 8: 25.
7. Materazzo M, Facchini A, Garozzo D, Buonomo C, Pellicciaro M, Vanni G. Maintaining good practice in breast cancer management and reducing the carbon footprint of care: study protocol and preliminary results. WCRJ 2022; 9: e2438.
8. Berretta M, Facchini BA, Garozzo D, Necci V, Taibi R, Torrisi C, Ficarra G, Bitto A. Adapted physical activity for breast cancer patients: shared considerations with two Olympic and world Italian sports champions. Eur Rev Med Pharmacol Sci 2022; 26: 5393-5398.
9. Mohamed R, Melek M, Eid S, Morsy A. The correlation between increasing Body Mass Index and the incidence of local recurrence and distant metastasis in breast cancer patients. WCRJ 2023; 10: e2553.
10. Associazione Italiana di Oncologia Medica. I NUMERI DEL CANCRO IN ITALIA 2019 Available from: https://www.aiom.it/wp-content/uploads/2019/09/2019_Numeri_Cancro-operatori-web.pdf
11. Dominici L, Hu J, Zheng Y, Kim HJ, King TA, Ruddy KJ, Tamimi RM, Peppercorn J, Schapira L, Borges VF, Come SE, Warner E, Wong JS, Partridge AH, Rosenberg SM. Association of Local Therapy With Quality-of-Life Outcomes in Young Women With Breast Cancer. JAMA Surg 2021; 156: e213758-e213758.
12. Rosenberg SM, Dominici LS, Gelber S, Poorvu PD, Ruddy KJ, Wong JS, Tamimi RM, Schapira L, Come S, Peppercorn JM, Borges VF, Partridge AH. Association of Breast Cancer Surgery With Quality of Life and Psychosocial Well-being in Young Breast Cancer Survivors. JAMA Surg 2020; 155: 1035.
13. Dimitrov G, Atanasova M, Popova Y, Vasileva K, Milusheva Y, Troianova P. Molecular and genetic subtyping of breast cancer: the era of precision oncology. WCRJ 2022; 9: e2367.
14. Halsted WS. The Results of Operations for the cure of Cancer of the Breast performed at the Johns Hopkins Hospital from June, 1889, to January, 1894. Ann Surg 1894; 20.
15. Fisher B, Anderson S, Bryant J, Margolese RG, Deutsch M, Fisher ER, Jeong J-H, Wolmark N. Twenty-year follow-up of a randomized trial comparing total mastectomy, lumpectomy, and lumpectomy plus irradiation for the treatment of invasive breast cancer. N Engl J Med 2002; 347 1233-1241.

16. Veronesi U, Saccozzi R, Del Vecchio M, Banfi A, Clemente C, De Lena M, Gallus G, Greco M, Luini A, Marubini E, Muscolino G, Rilke F, Salvadori B, Zecchini A, Zucali R. Comparing radical mastectomy with quadrantectomy, axillary dissection, and radiotherapy in patients with small cancers of the breast. N Engl J Med 1981; 305: 6-11.
17. Veronesi U, Saccozzi R, Del Vecchio M, Banfi A, Clemente C, De Lena M, Gallus G, Greco M, Luini A, Marubini E, Muscolino G, Rilke F, Salvadori B, Zecchini A, Zucali R. Sentinel lymph node biopsy in breast cancer: ten-year results: of a randomized controlled study. Ann Surg 2010; 251: 595-600.
18. Galimberti V, Cole BF, Zurrida S, Viale G, Luini A, Veronesi P, Baratella P, Chifu C, Sargenti M, Intra M, Gentilini O, Mastropasqua MG, Mazzarol G, Massarut S, Garbay JR, Zgajnar J, Galatius H, Recalcati A, Littlejohn D, Bamert M, Colleoni M, Price KN, Regan MM, Goldhirsch A, Coates AS, Gelber RD, Veronesi U; International Breast Cancer Study Group Trial 23-01 investigators. Axillary dissection versus no axillary dissection in patients with breast cancer and sentinel-node micrometastases (IBCSG 23-01): 10-year follow-up of a randomised, controlled phase 3 trial. Lancet Oncol 2018; 19: 1385-1393.
19. Gentilini O, Veronesi U. Staging the Axilla in Early Breast Cancer: Will Imaging Replace Surgery? JAMA Oncol 2015; 1: 1031-1032.
20. Sparano JA, Gray RJ, Makower DF, Pritchard KI, Albain KS, Hayes DF, Geyer CE Jr, Dees EC, Goetz MP, Olson JA Jr, Lively T, Badve SS, Saphner TJ, Wagner LI, Whelan TJ, Ellis MJ, Paik S, Wood WC, Ravdin PM, Keane MM, Gomez Moreno HL, Reddy PS, Goggins TF, Mayer IA, Brufsky AM, Toppmeyer DL, Kaklamani VG, Berenberg JL, Abrams J, Sledge GW Jr. Adjuvant Chemotherapy Guided by a 21-Gene Expression Assay in Breast Cancer. N Engl J Med 2018; 379: 111-121.
21. Kalinsky K, Barlow WE, Gralow JR, Meric-Bernstam F, Albain KS, Hayes DF. 21-Gene Assay to Inform Chemotherapy Benefit in Node-Positive Breast Cancer. N Engl J Med 2021; 385: 2336-2347.
22. Özgüzer A, Ertan Özgüzer G. The smallest subtype in the SEER Database: estrogen receptor negative progesterone receptor positive breast cancer. WCRJ 2021; 8: e1848.
23. F Ferroni P, Roselli M, Spila A, D'Alessandro R, Portarena I, Mariotti S, Palmirotta R, Buonomo O, Petrella G, Guadagni F. Serum sE-selectin levels and carcinoembryonic antigen mRNA-expressing cells in peripheral blood as prognostic factors in colorectal cancer patients. Cancer 2010; 116: 2913-2921.
24. Bao X, Wenli L, Sun T, Wang J, Liu X, Li M, ZW Z. Clinical data analysis of CDKs expression and prognosis in breast cancer. WCRJ 2023; 10: e2475.
25. Merrill AY, Ochoa D, Klimberg VS, Hill EL, Preston M, Neisler K, Henry-Tillman RS, Henry-Tillman RS, Surg A. Cutting Healthcare Costs with Hematoma-Directed Ultrasound-Guided Breast Lumpectomy. Ann Surg Oncol 2018; 25: 3076-3081.
26. Gentilini O, Veronesi U. Abandoning sentinel lymph node biopsy in early breast cancer? A new trial in progress at the European Institute of Oncology of Milan (SOUND: Sentinel node vs Observation after axillary UltraSouND). Breast 2012; 21: 678-681.
27. Shah H, Surujballi J, Awan AA, Hutton B, Arnaout A, Shorr R, Vandermeer L, Alzahrani MJ, Clemons M. A scoping review characterizing "Choosing Wisely®" recommendations for breast cancer management. Breast Cancer Res Treat 2021; 185: 533-547.
28. Vanni G, Caiazza G, Materazzo M, Storti G, Pellicciaro M, Buonomo C, Natoli S, Fabbi E, Dauri M. Erector Spinae Plane Block Versus Serratus Plane Block in Breast Conserving Surgery: A Randomized Controlled Trial. Anticancer Res 2021; 41: 5667-5676.
29. Ambrogi V, Forcella D, Gatti A, Vanni G, Mineo TC. Transthoracic repair of Morgagni's hernia: a 20-year experience from open to video-assisted approach. Surg Endosc 2007; 21: 587-591.
30. Vanni G, Materazzo M, Perretta T, Meucci R, Anemona L, Buonomo C, Dauri M, Granai AV, Rho M, Ingallinella S, Tacconi F, Ambrogi V, Chiaravalloti A, Schillaci O, Petrella G, Buonomo OC. Impact of awake breast cancer surgery on postoperative lymphocyte responses. In Vivo 2019; 33: 1879-1884.
31. Golshan M, Cirrincione CT, Sikov WM, Carey LA, Berry DA, Overmoyer B, Henry NL, Somlo G, Port E, Burstein HJ, Hudis C, Winer E, Ollila DW, for the Alliance for Clinical Trials in Oncology. Impact of neoadjuvant therapy on eligibility for and frequency of breast conservation in stage II–III HER2-positive breast cancer: surgical results of CALGB 40601 (Alliance). Breast Cancer Res Treat 2016; 160: 297-304.
32. Landercasper J, Bennie B, Parsons BM, Dietrich LL, Greenberg CC, Wilke LG, Linebarger JH. Fewer Reoperations After Lumpectomy for Breast Cancer with Neoadjuvant Rather than Adjuvant Chemotherapy: A Report from the National Cancer Database. Ann Surg Oncol 2017; 24: 1507-1515.
33. Buonomo OC, Grasso A, Pistolese CA, Anemona L, Portarena I, Meucci R, Morando L, Deiana C, Materazzo M, Vanni G. Evaluation of Concordance Between Histopathological, Radiological and Biomolecular Variables in Breast Cancer Neoadjuvant Treatment. Anticancer Res 2020; 40: 281-286.
34. Spring LM, Fell G, Arfe A, Sharma C, Greenup R, Reynolds KL, Smith BL, Alexander B, Moy B, Isakoff SJ, Parmigiani G, Trippa L, Bardia A. Pathologic Complete Response after Neoadjuvant Chemotherapy and Impact on Breast Cancer Recurrence and Survival: A Comprehensive Meta-analysis. Clin Cancer Res 2020; 26: 2838-2848.
35. Burstein HJ, Curigliano G, Thürlimann B, Weber WP, Poortmans P, Regan MM, Senn HJ, Winer EP, Gnant M, Panelists of the St Gallen Consensus Conference. Customizing local and systemic therapies for women with early breast cancer: the St. Gallen International Consensus Guidelines for treatment of early breast cancer 2021. Ann Oncol 2021; 32: 1216-1235.
36. Vanni G, Santori F, Pellicciaro M, Materazzo M, Caspi J, Granai AV, de Majo A, Servadei F, Giacobbi E, Perretta T, Meucci R, Pistolese CA, Buonomo OC. Extremely advanced breast cancer presentation: Possible effect of coronavirus pandemicanxiety. In Vivo 2021; 35: 2331-2335.
37. Vanni G, Pellicciaro M, Materazzo M, Pedini D, Portarena I, Buonomo C, Perretta T, Rizza S, Pistolese C, Buonomo O. Advanced Stages and Increased Need for Adjuvant Treatments in Breast Cancer Patients: The Effect of the One-year COVID-19 Pandemic. Anticancer Res 2021; 41: 2689-2696.
38. Kuerer HM, Smith BD, Krishnamurthy S, Yang WT, Valero V, Shen Y, Lin H, Lucci A, Boughey JC, White RL, Diego EJ, Rauch GM, Moseley TW, van la Parra RF, Adrada BE, Leung JW, Sun SX, Teshome M, Miggins M V., Hunt KK, DeSnyder SM, Ehlers RA, Hwang RF, Colen JS, Arribas E, Samiian L, Lesnikoski BA, Piotrowski M, Bedrosian I, Chong C, Refinetti AP, Huang M, Candelaria RP, Loveland-Jones C, Mitchell MP, Shaitelman SF. Eliminating breast surgery for invasive breast cancer in exceptional responders to neoadjuvant systemic therapy: a multicentre, single-arm, phase 2 trial. Lancet Oncol 2022; 23: 1517-1524.
39. Caputo R, Cianniello D, Giordano A, Piezzo M, Riemma M, Trovò M, Berretta M, De Laurentiis M. Gene Expression Assay in the Management of Early Breast Cancer. Curr Med Chem 2020; 27: 2826-2839.
40. Pukancsik D, Kelemen P, Újhelyi M, Kovács E, Udvarhelyi N, Mészáros N, Kenessey I, Kovács T, Kásler M, Mátrai Z. Objective decision making between conventional and oncoplastic breast-conserving surgery or mastectomy: An aesthetic and functional prospective cohort study. Eur J Surg Oncol 2017; 43: 303-310.