

Mastectomy for Women with Breast Cancer, Types and Considerations

Balsam Alturky^{1*}, Bandar Bin Shujaa Alotaibi², Mohammed Ahmed Almasabi³, Maryam Ali Habibi⁴, Abdulaziz Ibrahim Alghamdi⁵, Ali Hussain Alnahwi⁶, Alabbas Saleh Alghamdi⁵, Sultan Abdullah Bin Jerais², Zainab Adel Alsaffar⁶, Omar Safar Alshahrani⁷ and Majed Abdullah Almuafa⁵

¹Consultant of General and Breast Surgery, Program Director of General Surgery, East Jeddah General Hospital, Jeddah, Saudi Arabia

²Almaarefa University-Riyadh, Saudi Arabia

³Hera General Hospital, Mecca, Saudi Arabia

⁴King Fahad Central Hospital, Jazan, Saudi Arabia

⁵Al-Baha University, Al Baha, Saudi Arabia

⁶Jubail General Hospital, Jubail, Saudi Arabia

⁷Armed Forces Hospitals Southern Region, Khamis Mushait, Saudi Arabia

***Corresponding Author:** Balsam Alturky, Consultant of General and Breast Surgery, Program Director of General Surgery, East Jeddah General Hospital, Jeddah, Saudi Arabia.

Received: October 19, 2019; **Published:** November 26, 2019

Abstract

Introduction: Breast cancer constitutes the most common cancer in women around the world. The surgical operation that involves a complete removal of the breast tissue is called mastectomy. Mastectomy is a surgical option for patients diagnosed with breast cancer. In addition, mastectomy could be a preventive measure to reduce the risk of breast cancer in selective cases of high-risk women.

Aim of work: In this review, we will discuss variable aspects of mastectomy for women with breast cancer including types, indications, management of the axilla, techniques, and complications of mastectomy.

Methodology: A comprehensive and systematic search was conducted regarding surgical intervention of breast cancer. PubMed and Google Scholar search engine were the mainly used database.

Conclusions: In the United States, more than 25 thousand women were diagnosed with breast cancer in 2017 alone. Mastectomy is a surgical option for patients diagnosed with breast cancer and preventive measure in a selective number of cases. Surgical mastectomy is reserved for breast cancer cases who do not fit the breast-conserving approach. Mostly, the operation include the removal of the nipple-areolar complex, some overlying skin, and the pectoral fascia. However, there is some differences between types of mastectomy. Complications after mastectomy include seroma, wound infection, skin flap necrosis, chest wall pain, phantom breast syndrome, and arm morbidity.

Keywords: Mastectomy; Breast Cancer; Considerations

Introduction

Sparing non-melanoma skin cancer, breast cancer constitutes the most common cancer in women around the world [1]. In the United States, more than 25 thousand women were diagnosed with breast cancer in 2017 alone, and will affects 12% of all women in the US in

some point of their life [2]. The surgical operation that involves a complete removal of the breast tissue is called mastectomy. Mastectomy is a surgical option for patients diagnosed with breast cancer. In addition, mastectomy could be a preventive measure to reduce the risk of breast cancer in selective cases of high-risk women. In addition to indications and techniques, surgeons must comprehend the complex anatomy of the chest wall and axilla in order to ensure effective removal of all breast tissue with maximum preservation of muscularity and sensation.

In this review, we will discuss variable aspects of mastectomy for women with breast cancer including types, indications, management of the axilla, techniques and complications of mastectomy. Axillary anatomy and dissection will not be discussed here.

Methods

A comprehensive and systematic search was conducted regarding surgical intervention for breast cancer. PubMed search engine (<http://www.ncbi.nlm.nih.gov/>) and Google Scholar search engine (<https://scholar.google.com>) were the mainly used database. All relevant available and accessible articles of all types were reviewed and included. Case reports and case series were used for rarely reported conditions. The terms used in search were: mastectomy, breast cancer, surgery versus conservative approaches, and mastectomy complications.

Types of patients

Surgical mastectomy is reserved for breast cancer cases who do not fit the breast-conserving approach, patients' decision to have the operation, and as preventive measure to reduce the risk of breast cancer.

Diffuse malignant micro-calcifications on mammography is one of the main criteria for mastectomy. Nevertheless, patients show the presence of more than one primary focal lesion that involve more than one quadrant of the breast (Multicentric) is also considered a candidate for surgical mastectomy. However, if the two focal tumor could be excised within a single specimen that does not affect cosmetic appearance, breast-conserving therapy can be considered. Mastectomy could be considered in women with previous history of chest radiation for any reason. This is due to the fear of high risk carried with excessive radiation. Example of this is a prior breast radiation or chest wall radiation for lymphoma. This excessive total dose of radiation may increase the risk of other primary malignancies in the future. With third trimester exception, pregnant women with breast cancer is not suitable for conservative management as radiation is an absolute contraindication in these patients. Postponing breast radiation could be an alternatives that allow conservative approach. If repetitive attempts of conservative resections continue to yield a positive margins, breast mastectomy should be considered. Moreover, a relatively large tumor size in relation to the size of breast could be a criterion for mastectomy choice.

Informed patient preference should be respected, some women with breast cancer may prefer mastectomy rather than breast-conserving therapy. Such a decision could be an attempt to avoid post-operative radiation, periodic screening or biopsy. When both conservative and mastectomy are acceptable, patients should be fully informed about the pros and cons of these interventions. Physicians should discuss cosmetic consequences of both options, while mastectomy may need post-operative reconstruction, breast-conserving surgery may result in unacceptable cosmetic appearance especially if the patient has a small amount of breast tissue. Skin-sparing mastectomy with or without preservation of the nipple-areolar complex followed by subsequent immediate reconstruction provides superior cosmetic results.

Mastectomy as prophylaxis measures in patient with hereditary breast and ovarian syndrome and patients with mutations of BRCA1 and BRCA2 susceptibility gene. Some reports suggested that prophylactic mastectomy may reduce the risk of breast cancer by more than 90 percent [3,4]. A contralateral mastectomy may be an option for patients with unilateral breast cancer and carry BRCA1 or BRCA2 mutation [5].

Types of mastectomy

Mastectomy is defined as a surgical procedure that aims to complete resection of the breast tissue. Mostly, the operation include the removal of the nipple-areolar complex, some overlying skin, and the pectoral fascia. However, there is some differences between types of mastectomy.

Radical mastectomy (Halsted mastectomy) consists of en bloc removal of the breast, the overlying skin, the pectoralis major and minor muscles of chest wall, and the entire axillary lymph nodes. This vigorous resection was believed to have the best chance of cancer resection and control; it was the standard surgery for decades [5]. Although radical mastectomy actually has a very good local control, the curative potential remained limited. A 30 years follow-up of 1438 women who underwent radical mastectomy, only 13 percent remained free of the disease while 57 percent had died yet of breast cancer [6]. Further attempts to expand the resection to include the internal mammary nodes (an operation know as “extended radical mastectomy”) failed to improve survival [7,8]. Hence, the lack of advantages on survival has rendered the radical mastectomy as a rare option.

Modified radical mastectomy (MRM) is another type of mastectomy, the operation is designed to complete removal of the breast and the underlying fascia of the pectoralis major muscle along with the removal of the level I and II axillary lymph nodes. A number of randomized trials concluded that this modified operation is less extensive, has an equivalent survival rate, and lower morbidities [9-12]. Women with breast cancer and evidence of axillary metastasis are the typical candidates for MRM.

Simple mastectomy is another type of mastectomy that involves the complete removal of breast tissue, however, with preservation of pectoralis muscles and axillary lymph nodes. Nowadays, with the presence of sentinel node biopsy, simple mastectomy is becoming more frequent than before.

In contrast to previous conventional mastectomy, skin-sparing mastectomy (SSM) is a delicate technique that aims to preserve natural breast skin envelope [13,14]. However, the scar of biopsy or the skin directly overlying the tumor could be excised. The excision of breast tissue is achieved through a circular incision around the nipple-areolar complex. If there is a need for axillary access, a lateral extension could be performed. This procedure offers a very excellent reconstruction chance with more natural shape and contour. Thus, this type of mastectomy is gaining more popularity in the United States and Europe [15-18]. SSM is safe and acceptable option for the surgical management of patients with noninvasive breast cancer (DCIS) as well as stage I, II, or III breast cancer [19,20]. It is also an acceptable option for prophylaxis in high-risk women [21]. The local recurrence rate of breast cancer following SSM was estimated to tinge from 0 to 7 percent in both retrospective and cohort studies. This results is acceptable and comparable to a conventional mastectomy [13,17-20,22-24]. A meta-analysis studies, with median follow-up between 37 to 101 months, found similarity in local recurrence rates between patients with SSM and immediate reconstruction compared to those underwent the standard mastectomy without reconstruction [20]. This procedure is contraindicated in case of dermal lymphatic invasion as in cases of inflammatory breast cancer (IBC), in addition, it is not suitable for women having nipple retraction, clinical involvement of the NAC, Paget disease, bloody nipple discharge, or multicentricity [20,25,26].

In a nipple-areolar sparing mastectomy (NSM), the surgeon preserves the dermis and epidermis of the nipple. However, the major ducts should be removed from within the nipple lumen [27]. This type of operation suites a selective cases as women who are having surgery as preventive measures with planning of immediate reconstruction [15,25,28-31]. NSM is gaining more acceptance as a surgical option for breast cancer treatment. It carries the advantages of being suitable for women with small to moderate size breast, because the technique of NSM results in large flaps. Considering this procedure on women with established breast cancer should be attempted carefully, many researchers have suggested its use to women with small, peripherally located tumors, without multicentricity [32,33]. To detect the proximity between focal lesion and nipple-areolar complex NAC, clinical breast examination is comparable with MRI. In one retrospective study, the preoperative examination detected 61 percent of patients with confirmed NAC involvement versus 56 percent that was detected by MRI. Hence, MRI use does not carry any advantages [34]. The adequate NSM must involves intraoperative biopsy

and histological examination of the retro areolar margin. There is no consensus on a precise measurement of a negative margin and the biopsies of the areola and nipple are not completely reliable in predicting occult involvement. In one retrospective study with 438 NSM specimens found that 5 percent had positive subareolar duct margins [35]. NAC necrosis is a major complication of NSM. One study has estimated the risk of NAC necrosis to be 18 percent with no difference between smoker and non-smoker women [36]. It is worth to mention, however, that the NSM is considered a safe operation and 72 percent of all patients had no complications at all.

Clinical trials examining the recurrence rate after NSM are absent with a very limited number of cohort follow-up [27,36-39]. A recent meta-analysis of 20 studies that was published in 2015, which included 5594 patients, showed that at < 3-year, 3- to 5-year, and > 5-year follow-up, NSM resulted in comparable overall survival, disease-free survival, and local and nipple-areolar recurrence to MRM and SSM operations [40].

Preoperative preparation

Surgeons should mark the site and side of cancer focal perioperatively, the correct breast to be removed should be identified and confirmed with the patient, then marked with a water-soluble ink. Prophylactic antibiotic that covers skin flora as cefazolin should be given within one hour before the incision [41-44]. The use of preoperative antibiotic was associated with great reduction in risk of infection when compared with placebo; evidenced by a meta-analysis of the randomized controlled trials (RCT) [45].

Deep venous thrombosis prophylaxis should be considered in women undergoing a general anesthesia. Some researchers suggest sequential compression devices rather than the usage of systemic prophylaxis due to the low risk of DVT after breast surgery. In addition, systemic prophylaxis is associated with a higher incidence of surgical wound hematoma. A large study has estimated the risk of DVT after breast surgery to be 0.16 percent when simple prophylactic measures as compression stockings and early ambulation were used [46]. Patients with a positive history of thrombosis or coagulation disorder are at higher risk of post-operative DVT, hence, subcutaneous heparin is more ideal prophylactic approach in these patients.

Chemotherapy

Neoadjuvant chemotherapy may permit a breast conservation approach for selected patients with initial tumor sizes that require mastectomy and it does not compromise excellent outcome for patients with early stage disease. Neoadjuvant chemotherapy does increase the complexity of breast conservative treatment and requires a close collaboration between multidisciplinary team to achieve excellent outcome.

Complications

Similarly to most surgical operation, mastectomy carries the risk of various complications which differ in the incidence and morbidity. A collection of serous fluid under the skin flaps leads to what is called "seroma". This is a common complication following breast and axillary surgery [47-49]. If left untreated, seroma may lead to delayed wound healing, wound infection which leads to lymphedema, flap necrosis, and poor cosmetic outcome [50]. The pathophysiology behind seroma formation is poorly understood, however, the incidence of seroma formation is increased with obesity, extensive surgery type, and the use of electrocautery for skin flap dissection [51-54]. Seromas are more likely to occur after mastectomy than with breast conservative approach [55,56]. The usage of drains is an effective method for seroma prevention in most cases because they obliterate the dead space between the skin flap and the pectoralis muscle [57]. Suturing the skin flaps to the underlying muscle is another approach to obliterate the dead space and prevent seroma formation. However, this method may compromise the cosmetic outcome [49,57]. Studies declined the benefits of other methods as sealants and sclerotherapy, tetracycline, fibrin glues, patches, and the use of external compression dressings [58-60]. Excessive shoulder exercises postoperatively can increase the incidence of seroma formation. This does not contradict patients' encouragement to use their arms normally for daily activities, formal exercises should be postponed until the drains are removed and any seroma is resolved [61].

Generally, postoperative wound infection after breast surgery are less common complication due to the fact that mastectomy is a clean procedures [62-66]. One study has estimated the risk of wound infection to be 2.9 percent [67]. Obesity, smoking, older age, and diabetes mellitus have been identified to be associated with an increased risk of infection after breast surgery [68]. There is fourfold increase in the risk of wound infection following breast surgery among smokers compared with non-smokers [64]. Skin flora especially staphylococcal are the main incriminated organisms [69]. Most cases of postoperative wound infection and cellulitis can be managed with oral antibiotics, however, nonresponsive or extensive infection may require intravenous antibiotics.

Skin flap necrosis may complicate modified radical mastectomy (MRM) or simple mastectomy. The estimated rate was 10 to 18 percent [70,71]. Full-thickness skin flap necrosis requires further surgical intervention and debridement with the possibility of skin grafting need. This may lead to adjuvant treatment delaying and negatively affect the cosmetic outcome [72]. Risk factors for skin flap necrosis include prior radiation treatment, smoking, older age, and obesity. Technical methods of decreasing the risk of skin flap necrosis include minimizing the use of electric cautery method in dissection, maintaining appropriate skin flap thickness, and avoiding tension on closure of the incision. Subcutaneous injection of tumescence solution is associated with a high risk of flap necrosis [72,73]. The tumescent technique during mastectomy was associated with a 4 fold increase in the risk of skin flap necrosis compared with mastectomies performed without tumescence [72].

Post-mastectomy pain could be in the form of burning, aching, and tight constriction of the axilla, upper arm, and chest wall. In the past, less than 10 percent of patient developed chronic pain after mastectomy [74]; however, this has increased recently and some report has estimated the prevalence of chronic pain, paresthesia's, and phantom sensations to affect 50 percent of these patients [75]. The increased risk could be attributed to radiation and chemotherapy, which are often needed in addition to surgery. Factors that contribute to the development of postmastectomy pain include axillary dissection and breast reconstruction with implants after mastectomy [76,77]. The pain nature and location is crucial step in postoperative evaluation of pain after breast surgery. Atypical postmastectomy pain should prompt further evaluation for causes such infection, tumor recurrence, or other causes of chest pain, such as cardiac, pulmonary, or esophageal disease. Progressively worsening of chronic pain raises the suspicion of recurrent disease.

Patients may describe a change in chest wall sensation after mastectomy, sometimes described as "phantom breast syndrome" [78]. The sensation of residual breast tissue can persist for years after surgery [79]. Patients may feel pain, itching, nipple sensation, or erotic sensations. The mechanism behind this is not understood, this could be psychological [78]. Patient education before mastectomy, outlining the possible changes in chest wall sensation and the possibility of phantom breast syndrome, may help to relieve patient anxiety if symptoms develop and may even reduce the frequency of this syndrome.

After mastectomy, patient may experience arm swelling, pain, numbness, stiffness, and shoulder stiffness, pain, or nerve injury [80]. Rehabilitation services should be advised when needed and patients should be informed about methods to improve shoulder function and reduce the risk of lymphedema [81-83].

Patients can develop brachial plexopathy that is usually caused by a stretch injury due to intraoperative mispositioning. This can be avoided by careful positioning and the use of padded arm boards.

Conclusion

In the United States, more than 25 thousand women were diagnosed with breast cancer in 2017 alone. Mastectomy is a surgical option for patients diagnosed with breast cancer and preventive measure in a selective number of cases. Surgical mastectomy is reserved for breast cancer cases who do not fit the breast-conserving approach. Mostly, the operation include the removal of the nipple-areolar complex, some overlying skin, and the pectoral fascia. However, there is some differences between types of mastectomy. Complications after mastectomy include seroma, wound infection, skin flap necrosis, chest wall pain, phantom breast syndrome, and arm morbidity.

Bibliography

1. Bray F, *et al.* "Global cancer statistics: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries". *CA The Cancer Journal Clinical* 68.6 (2018): 394-424.
2. National Institutes of Health National Cancer Institute. Surveillance, Epidemiology, and End Results Program. Cancer stat facts: female breast cancer.
3. Hartmann LC, *et al.* "Efficacy of bilateral prophylactic mastectomy in BRCA1 and BRCA2 gene mutation carriers". *Journal of the National Cancer Institute* 93 (2001): 1633.
4. Rebbeck TR, *et al.* "Bilateral prophylactic mastectomy reduces breast cancer risk in BRCA1 and BRCA2 mutation carriers : the PROSE Study Group". *Journal of Clinical Oncology* 22 (2004): 1055.
5. Wong SM, *et al.* "Growing Use of Contralateral Prophylactic Mastectomy Despite no Improvement in Long-term Survival for Invasive Breast Cancer". *Annals of Surgery* (2016).
6. Adair F, *et al.* "Long-term followup of breast cancer patients: the 30-year report". *Cancer* 33 (1974): 1145.
7. Turner-Warwick RT. "The lymphatics of the breast". *British Journal of Surgery* 46 (1959): 574.
8. Veronesi U and Valagussa P. "Inefficacy of internal mammary nodes dissection in breast cancer surgery". *Cancer* 47 (1981): 170.
9. Turner L, *et al.* "Radical versus modified radical mastectomy for breast cancer". *Annals of the Royal College of Surgeons of England* 63 (1981): 239.
10. Maddox WA, *et al.* "A randomized prospective trial of radical (Halsted) mastectomy versus modified radical mastectomy in 311 breast cancer patients". *Annals of Surgery* 198 (1983): 207.
11. Fisher B, *et al.* "Ten-year results of a randomized clinical trial comparing radical mastectomy and total mastectomy with or without radiation". *The New England Journal of Medicine* 312 (1985): 674.
12. Cuzick J, *et al.* "Overview of randomized trials of postoperative adjuvant radiotherapy in breast cancer". *Cancer Treatment Reviews* 71 (1987): 15.
13. Simmons RM and Adamovich TL. "Skin-sparing mastectomy". *Surgical Clinics of North America* 83 (2003): 885.
14. Toth BA and Lappert P. "Modified skin incisions for mastectomy: the need for plastic surgical input in preoperative planning". *Plastic and Reconstructive Surgery* 87 (1991): 1048.
15. Gerber B, *et al.* "Skin-sparing mastectomy with conservation of the nipple-areola complex and autologous reconstruction is an oncologically safe procedure". *Annals of Surgery* 238 (2003): 120.
16. Kroll SS, *et al.* "Local recurrence risk after skin-sparing and conventional mastectomy : a 6-year follow-up". *Plastic and Reconstructive Surgery* 104 (1999): 421.
17. Medina-Franco H, *et al.* "Factors associated with local recurrence after skin-sparing mastectomy and immediate breast reconstruction for invasive breast cancer". *Annals of Surgery* 235 (2002): 814.
18. Carlson GW, *et al.* "Local recurrence after skin-sparing mastectomy : tumor biology or surgical conservatism?". *Annals of Surgical Oncology* 10 (2003): 108.

19. Warren Peled A., *et al.* "Outcomes after total skin-sparing mastectomy and immediate reconstruction in 657 breasts". *Annals of Surgical Oncology* 19 (2012): 3402.
20. Lanitis S., *et al.* "Comparison of skin-sparing mastectomy versus non-skin-sparing mastectomy for breast cancer: a meta-analysis of observational studies". *Annals of Surgery* 251 (2010): 632.
21. Peled AW., *et al.* "Total skin-sparing mastectomy in BRCA mutation carriers". *Annals of Surgical Oncology* 21 (2014): 37.
22. Newman LA., *et al.* "Presentation, treatment, and outcome of local recurrence after skin-sparing mastectomy and immediate breast reconstruction". *Annals of Surgical Oncology* 5 (1998): 620.
23. Simmons RM., *et al.* "Local and distant recurrence rates in skin-sparing mastectomies compared with non-skin-sparing mastectomies". *Annals of Surgical Oncology* 6 (1999): 676.
24. Slavin SA., *et al.* "Skin-sparing mastectomy and immediate reconstruction: oncologic risks and aesthetic results in patients with early-stage breast cancer". *Plastic and Reconstructive Surgery* 102 (1998): 49.
25. Blechman KM., *et al.* "The lateral inframammary fold incision for nipple-sparing mastectomy: outcomes from over 50 immediate implant-based breast reconstructions". *The Breast Journal* 19 (2013): 31.
26. Dawood S., *et al.* "International expert panel on inflammatory breast cancer : consensus statement for standardized diagnosis and treatment". *Annals of Oncology* 22 (2011): 515.
27. Chung AP and Sacchini V. "Nipple-sparing mastectomy: where are we now?". *Surgical Oncology* 17 (2008): 261.
28. Crowe JP., *et al.* "Nipple-sparing mastectomy: technique and results of 54 procedures". *Archives of Surgery* 139 (2004): 148.
29. Cense HA., *et al.* "Nipple-sparing mastectomy in breast cancer : a viable option?". *European Journal of Surgical Oncology* 27 (2001): 521.
30. Wijayanayagam A., *et al.* "Optimizing the total skin-sparing mastectomy". *Archives of Surgery* 143 (2008): 38.
31. Laronga C., *et al.* "The incidence of occult nipple-areola complex involvement in breast cancer patients receiving a skin-sparing mastectomy". *Annals of Surgical Oncology* 6 (1999): 609.
32. Spear SL., *et al.* "Nipple-sparing mastectomy". *Plastic and Reconstructive Surgery* 123 (2009): 1665.
33. Tokin C., *et al.* "Oncologic safety of skin-sparing and nipple-sparing mastectomy: a discussion and review of the literature". *International Journal of Surgical Oncology* 2012 (2012): 921821.
34. Steen ST., *et al.* "Predicting nipple-areolar involvement using preoperative breast MRI and primary tumor characteristics". *Annals of Surgical Oncology* 20 (2013): 633.
35. Camp MS., *et al.* "Management of positive sub-areolar/nipple duct margins in nipple-sparing mastectomies". *The Breast Journal* 20 (2014): 402.
36. Fortunato L., *et al.* "When mastectomy is needed: is the nipple-sparing procedure a new standard with very few contraindications?". *Journal of Surgical Oncology* 108 (2013): 207.
37. Murthy V and Chamberlain RS. "Defining a place for nipple sparing mastectomy in modern breast care: an evidence based review". *The Breast Journal* 19 (2013): 571.

38. Gerber B., *et al.* "The oncological safety of skin sparing mastectomy with conservation of the nipple-areola complex and autologous reconstruction: an extended follow-up study". *Annals of Surgery* 249 (2009): 461.
39. De Alcantara Filho P., *et al.* "Nipple-sparing mastectomy for breast cancer and risk-reducing surgery: the Memorial Sloan-Kettering Cancer Center experience". *Annals of Surgical Oncology* 18 (2011): 3117.
40. De La Cruz L., *et al.* "Overall Survival, Disease-Free Survival, Local Recurrence, and Nipple-Areolar Recurrence in the Setting of Nipple-Sparing Mastectomy: A Meta-Analysis and Systematic Review". *Annals of Surgical Oncology* 22 (2015): 3241.
41. Leaper DJ and Melling AG. "Antibiotic prophylaxis in clean surgery: clean non-implant wounds." *Journal of Chemotherapy* 13 Spec No 1 (2001): 96.
42. Gagliardi AR., *et al.* "Factors influencing antibiotic prophylaxis for surgical site infection prevention in general surgery : a review of the literature". *Canadian Journal of Surgery* 52 (2009): 481.
43. Throckmorton AD., *et al.* "Postoperative prophylactic antibiotics and surgical site infection rates in breast surgery patients". *Annals of Surgical Oncology* 16 (2009): 2464.
44. Braxton CC., *et al.* "Improving antibiotic stewardship: order set implementation to improve prophylactic antimicrobial prescribing in the outpatient surgical setting". *The Journal of Ambulatory Care Management* 33 (2010): 131.
45. Tejirian T., *et al.* "Antibiotic prophylaxis for preventing wound infection after breast surgery: a systematic review and metaanalysis". *Journal of the American College of Surgeons* 203 (2006): 729.
46. Andtbacka RH., *et al.* "Incidence and prevention of venous thromboembolism in patients undergoing breast cancer surgery and treated according to clinical pathways". *Annals of Surgery* 243 (2006): 96.
47. Anand R., *et al.* "A prospective randomised trial of two treatments for wound seroma after breast surgery". *European Journal of Surgical Oncology* 28 (2002): 620.
48. Boostrom SY., *et al.* "Incidence of clinically significant seroma after breast and axillary surgery". *Journal of the American College of Surgeons* 208 (2009): 148.
49. van Bommel AJ., *et al.* "Prevention of seroma formation after axillary dissection in breast cancer: a systematic review". *European Journal of Surgical Oncology* 37 (2011): 829.
50. Agrawal A., *et al.* "Concepts of seroma formation and prevention in breast cancer surgery". *ANZ Journal of Surgery* 76 (2006): 1088.
51. Porter KA., *et al.* "Electrocautery as a factor in seroma formation following mastectomy". *The American Journal of Surgery* 176 (1998): 8.
52. Pogson CJ., *et al.* "Seroma following breast cancer surgery". *European Journal of Surgical Oncology* 29 (2003): 711.
53. Bonnema., *et al.* "The composition of serous fluid after axillary dissection". *European Journal of Surgery* 165 (1999): 9.
54. Petrek JA., *et al.* "Axillary lymphadenectomy. A prospective, randomized trial of 13 factors influencing drainage, including early or delayed arm mobilization". *Archives of Surgery* 125 (1990): 378.
55. Gonzalez EA., *et al.* "Seroma formation following breast cancer surgery". *The Breast Journal* 9 (2003): 385.

56. Hashemi E., et al. "Seroma formation after surgery for breast cancer". *World Journal of Surgical Oncology* 2 (2004): 44.
57. Coveney EC., et al. "Effect of closing dead space on seroma formation after mastectomy--a prospective randomized clinical trial". *European Journal of Surgical Oncology* 19 (1993): 143.
58. Chen CY., et al. "The effect of a pressure garment on post-surgical drainage and seroma formation in breast cancer patients". *Singapore Medical Journal* 39 (1998): 412.
59. Sitzmann JV., et al. "The use of sclerotherapy for treatment of postmastectomy wound seromas". *Surgery* 93 (1983): 345.
60. O'Hea BJ., et al. "External compression dressing versus standard dressing after axillary lymphadenectomy". *The American Journal of Surgery* 177 (1999): 450.
61. Shamley DR., et al. "Delayed versus immediate exercises following surgery for breast cancer : a systematic review". *Breast Cancer Research and Treatment* 90 (2005): 263.
62. Wagman LD., et al. "A prospective, randomized double-blind study of the use of antibiotics at the time of mastectomy". *Surgery, gynecology and obstetrics* 170 (1990): 12.
63. Tran CL., et al. "Does reoperation predispose to postoperative wound infection in women undergoing operation for breast cancer?". *The American Journal of Surgery* 69 (2003): 852.
64. Sørensen LT., et al. "Smoking as a risk factor for wound healing and infection in breast cancer surgery". *European Journal of Surgical Oncology* 28 (2002): 815.
65. Nieto A., et al. "Determinants of wound infections after surgery for breast cancer". *Zentralbl Gynakol* 124 (2002): 429-433.
66. Chatzidaki P., et al. "Perioperative complications of breast cancer surgery in elderly women (≥80 years)". *Annals of Surgical Oncology* 18 (2011): 923.
67. Sanguinetti A., et al. "[Antibiotic prophylaxis in breast surgery. Preliminary results of a multicenter randomized study on 1400 cases]". *Annali Italiani di Chirurgia* 80 (2009): 275.
68. Vitug AF and Newman LA. "Complications in breast surgery". *Surgical Clinics of North America* 87 (2007): 431.
69. Platt R., et al. "Perioperative antibiotic prophylaxis and wound infection following breast surgery". *Journal of Antimicrobial Chemotherapy* 31(1993): 43.
70. Carlson GW., et al. "Skin-sparing mastectomy. Oncologic and reconstructive considerations". *Annals of Surgery* 225 (1997): 570.
71. Rao R., et al. "Prediction of post-operative necrosis after mastectomy: a pilot study utilizing optical diffusion imaging spectroscopy". *World Journal of Surgical Oncology* 7 (2009): 91.
72. Chun YS., et al. "Use of tumescent mastectomy technique as a risk factor for native breast skin flap necrosis following immediate breast reconstruction". *The American Journal of Surgery* 201 (2011): 160.
73. Abbott AM., et al. "Outcomes after tumescence technique versus electrocautery mastectomy". *Annals of Surgical Oncology* 19 (2012): 2607.
74. Elliott K and Foley KM. "Neurologic pain syndromes in patients with cancer". *Critical Care Clinics* 6 (1990): 393.

75. asmath T., *et al.* "Pain and other symptoms after different treatment modalities of breast cancer". *Annals of Oncology* 6 (1995): 453.
76. Maunsell E., *et al.* "Arm problems and psychological distress after surgery for breast cancer". *Canadian Journal of Surgery* 36 (1993): 315.
77. Wallace MS., *et al.* "Pain after breast surgery: a survey of 282 women". *Pain* 66 (1996): 195.
78. Jamison K., *et al.* "Phantom breast syndrome". *Archives of Surgery* 114 (1979): 93.
79. Krøner K., *et al.* "Long-term phantom breast syndrome after mastectomy". *The Clinical Journal of Pain* 8 (1992): 346.
80. Arndt V., *et al.* "Persistence of restrictions in quality of life from the first to the third year after diagnosis in women with breast cancer". *Journal of Clinical Oncology* 23 (2005): 4945.
81. Sclafani LM and Baron RH. "Sentinel lymph node biopsy and axillary dissection: added morbidity of the arm, shoulder and chest wall after mastectomy and reconstruction". *The Cancer Journal* 14 (2008): 216.
82. de Rezende LF., *et al.* "Two exercise schemes in postoperative breast cancer : comparison of effects on shoulder movement and lymphatic disturbance". *Tumori* 92 (2006): 55.
83. Torres Lacomba M., *et al.* "Effectiveness of early physiotherapy to prevent lymphoedema after surgery for breast cancer: randomised, single blinded, clinical trial". *BMJ* 340 (2010): b5396.

Volume 15 Issue 12 December 2019

©All rights reserved by Balsam Alturky, *et al.*