Computed Tomographic Findings of Postoperative Seroma in Breast Cancer Patients

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Purpose: Seroma formation at the surgical site is a common finding in postoperative breasts and should not be mistaken for tumor recurrence on imaging studies. The purpose of this study was to describe the computed tomography (CT) findings of postoperative seromas in patients who underwent surgery for breast cancer. **Methods:** The CT findings of surgical site seromas were evaluated retrospectively in 171 breast cancer patients who underwent surgery from January to December 2010. Chest CT is recommended twice a year for the first 3 years postoperatively and annually thereafter; we evaluated the incidence of surgical site seroma and the imaging findings on CT images. **Results:** Seroma (mean maximal diameter, 21 mm) was observed in 34 patients (29 at the mastectomy site and 6 at the axillae) on the initial follow-up CT. The lesion shapes included round (n = 11), oval (n = 12), and triangular (n = 12). Most of the seromas (n = 33) showed homogeneous attenuation, and all exhibited mild peripheral rim enhancement. During a median follow-up of 38 months (range, 10–50 months), 60% of seromas diminished in size and resolved completely at a mean 24 months postoperatively. The remainder of seromas (n = 14) persisted, though were smaller. **Conclusion:** Approximately 20% of surgically treated breast cancer patients had surgical site seromas visible on CT 6 months after surgery. The seromas varied in appearance, but should not be mistaken for tumor recurrence.

Key Words: Breast neoplasms, Seroma, Surgery, X-ray computed tomography

INTRODUCTION

Breast cancer is the most common cause of cancer in women globally and the second most common cancer in Korean women [1]. Surgery is the most common treatment and increases the likelihood of cure. Surgical treatment of breast cancer includes breast conservation therapy and mastectomy with or without axillary dissection, depending on the disease stage. Several lesions may occur and change over time on postoperative imaging studies. Seroma formation at surgical sites is frequently observed in the postoperative breast and should not be misdiagnosed as tumor recurrence on imaging studies such as mammography and ultrasonography [2].

Although not recommended by current guidelines, computed tomography (CT) is increasingly employed clinically for breast cancer patients [3,4]. However, no known study has examined postoperative seroma formation in breast cancer patients using CT. Accordingly, the present study characterized postoperative seromas in breast cancer patients using CT in order to help prevent misdiagnosis, avoid unnecessary follow-up examinations, and reduce patient anxiety.

METHODS

The Institutional Review Board of our hospital approved this retrospective study (IRB number: GBIRB2014-258), and the requirement for informed patient consent was waived.

Study population

The radiology database and medical record system of our institution were searched for chest CT examinations performed after breast cancer surgery from January to December 2010. Patients who had any

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history of previous surgery or procedures in the breasts and those who underwent immediate reconstruction surgery were excluded.

Computed tomography examination

After surgery, our institution generally recommends chest CT twice a year for the first 3 years and annually thereafter. Patients scheduled for postoperative radiotherapy underwent an additional planning CT 1 month postoperatively. All scans were performed using one of three helical scanners (SOMATOM Sensation 64, SOMATOM Definition, or SOMATOM Definition Flash; Siemens Healthcare, Forchheim, Germany). Images were generated at the following parameters: 100 or 120 kVp, 170 mA, 5 mm collimation, 10 mm/sec table feed speed, 1-second rotation time, and 5.0 mm slice thickness at 2.5 to 5.0 mm intervals. Postenhancement images were obtained 30 to 40 seconds after administering 120 mL nonionic iodinated contrast intravenously (Ultravist 300 mg/mL; Schering AG, Berlin, Germany) via the antecubital vein at 3 to 4 mL/sec.

Image analysis

Two subspecialty-trained chest radiologists retrospectively reviewed the postoperative chest CT images by consensus. The presence of seroma was evaluated at operative sites in the initial follow-up CT images obtained 6 months postoperatively. Seromas were evaluated based on location (mastectomy bed or axilla), size (maximal diameter), shape (round, oval, triangular shape), mean density (Hounsfield unit, HU), and the existence of peripheral enhancement using three-dimensional reconstructed CT images. Chronologic changes in the postoperative seromas were also evaluated using subsequent CT images. In patients who underwent CT for radiotherapy planning, earlier CT images were also evaluated for postoperative seroma formation.

Statistical analysis

The presence of postoperative seroma was evaluated, and the correlation to patient characteristics (age, body mass index) and tumor characteristics (tumor staging, histological grades, mode of surgery, radiotherapy) was analyzed using the Student t-test or chi-square test. Statistical significance was accepted at the 95% confidence level ($p < 0.05$). Data were analyzed using PASW version 17.0 (SPSS Inc., Chicago, USA) software.

RESULTS

Patients

A total 171 female patients (mean age, 53 ± 10 years) underwent breast cancer surgery during the study period; chest CT was performed in all cases. The patient characteristics are summarized in Table 1. Surgeries included modified radical mastectomy ($n = 44$), breast-conserving surgery ($n = 127$), axillary node dissection ($n = 89$), and sentinel node biopsy ($n = 82$). Of the 171 patients, 143 underwent radiotherapy. The median follow-up duration after surgery was 38 months (range, 10–50 months).

Postoperative seroma formation

A total 35 seromas were diagnosed in 34 patients (19.9%) at the initial follow-up CT at the mastectomy site ($n = 29$) and axilla ($n = 6$). The mean age, follow-up duration, body mass index, and tumor stage were similar between patients with postoperative seromas and those without. However, the surgery type differed significantly between these two patient groups. Postoperative seromas occurred more frequently in patients who underwent breast-conserving surgery than in those who underwent modified radical mastectomy (23.6% vs. 9.1%, respectively, $p = 0.037$), and was more frequent in patients who underwent sentinel node biopsy than in those who underwent axillary dissection (26.8% vs. 13.5%, respectively, $p = 0.029$) (Table 1).

The mean maximum diameter of fluid lesions was 20.9 ± 11.0 mm (range, 5.0–51.6 mm). Lesion shapes varied and included round ($n = 11$), oval ($n = 12$), and triangular ($n = 12$). Most seromas ($n = 33$) showed homogeneous attenuation (5–38 HU). The remaining two seromas were heterogeneous (mean density, 42 and 48 HU). All seromas showed mild peripheral rim enhancement (Figure 1). Early CT images for radiotherapy planning were obtained in 23 of 34 patients. Seromas were larger (mean maximal diameter, 30 ± 13.2 mm; range, 12–66 mm) on the early CT images than observed in the first follow-up CT. In serial follow-up CT images, seromas generally diminished in size over time and resolved completely a mean 24 months after surgery in 21 lesions (60.0%). Small seromas persisted in the remaining cases.

DISCUSSION

Fluid collection in the surgical bed, known as seroma, is a common

Table 1. Characteristics of the breast cancer patients

Characteristic	All (n = 171) No. (%)	No seroma (n = 137) No. (%)	Seroma (n = 34) No. (%)	p-value
Age (yr)*	53 ± 10	53 ± 10	56 ± 10	0.105 [†]
F/U duration (mo)*	40 ± 8	40 ± 7	38 ± 9	0.070 [†]
BMI (kg/m ²)*	24 ± 3	23 ± 3	24 ± 3	0.099 [†]
Stage				
0	2 (1.2)	1 (0.7)	1 (2.9)	0.290 [‡]
I	80 (46.8)	64 (46.7)	16 (47.1)	
II	53 (31.0)	40 (29.2)	13 (38.2)	
III	36 (21.1)	32 (23.4)	4 (11.8)	
T stage				
Tis	2 (1.2)	1 (0.7)	1 (2.9)	0.944 [‡]
T1	91 (53.2)	74 (54.0)	17 (50.0)	
T2	65 (38.0)	51 (37.2)	14 (41.2)	
T3	13 (7.6)	11 (8.0)	2 (5.9)	
N stage				
N0	105 (61.4)	80 (58.4)	25 (73.5)	0.101 [‡]
N1	32 (18.7)	27 (19.7)	5 (14.7)	
N2	23 (13.5)	20 (14.6)	3 (8.8)	
N3	11 (6.4)	10 (7.3)	1 (2.9)	
Subtype				
Luminal A	42 (24.6)	35 (25.5)	7 (20.6)	0.809 [‡]
Luminal HER2	74 (43.3)	57 (41.6)	17 (50.0)	
HER2 enriched	37 (21.6)	29 (21.2)	8 (23.5)	
Triple negative	18 (10.5)	16 (11.7)	2 (5.9)	
Histologic grade [§]				
Grade 1	17 (9.9)	14 (10.2)	3 (8.8)	0.815 [‡]
Grade 2	103 (60.2)	82 (60.0)	21 (61.8)	
Grade 3	48 (28.1)	38 (27.7)	10 (29.4)	
Unknown	3 (1.8)	3 (2.2)	0	
Operation type				
Modified radical mastectomy	44 (25.7)	40 (29.2)	4 (11.8)	0.037 [‡]
Breast-conserving surgery	127 (74.3)	97 (70.8)	30 (88.2)	
Axillary node dissection	89 (52.0)	77 (56.2)	12 (35.3)	0.029 [‡]
Sentinel node biopsy	82 (48.0)	60 (43.8)	22 (64.7)	
Radiation therapy	143 (83.6)	111 (81.0)	32 (97.0)	0.065 [‡]

F/U = follow up; BMI = body mass index; HER2 = human epidermal growth factor receptor 2.

*Mean ± SD; [†]Student t-test; [‡]Chi-square test or Fisher exact test; [§]Scarff-Bloom-Richardson grade system.

postoperative finding and has a reported incidence of 3% to 85% following breast cancer surgery. These lesions should not be confused with tumor recurrence in postoperative imaging studies [5]. Dead space is intentionally left intraoperatively to allow serous fluid to fill the space and achieve better cosmesis. Numerous surgical techniques (flap fixation techniques, sclerosants, fibrin glue, and sealants) and drain techniques (single or multiple drains, early or late removal, and with or without suction) have been attempted to reduce postoperative seroma formation, but the reported results are disparate and do not correlate with the incidence of seroma [6,7]. Furthermore, with the ex-

ception of body mass index, patient and tumor factors do not seem to affect seroma formation [6,7].

In the present study, the overall incidence of seroma was 19.9% at the first follow-up CT performed 6 months postoperatively [6,7]. There were no patient or tumor factors affecting seroma formation, except the surgery method; seromas occurred more frequently in patients who underwent breast-conserving surgery than in those who underwent total mastectomy (23.6% vs. 9.1%, respectively, $p = 0.037$), and after sentinel node biopsy than after axillary dissection (26.8% vs. 13.5%, respectively, $p = 0.029$). However, these results contradict find-

Figure 1. A 45-year-old female patient underwent breast-conserving surgery and axillary node dissection on the right side. (A) First follow-up computed tomography (CT) image obtained 6 months after surgery shows fluid collection (arrows) in the mastectomy bed. The maximum diameter of the fluid collection is 40 mm and it is triangular in shape, has homogeneous density (mean density 15 Hounsfield units), and exhibits mild peripheral rim enhancement. (B) CT obtained at 1 month after surgery for radiotherapy planning in the same patient shows larger fluid collection (maximum diameter, 55 mm) in the mastectomy bed. (C) CT obtained 2 years after surgery reveals a decrease in size (maximum diameter, 25 mm) as compared with that observed at 6 month after surgery.

ings in previous studies, which found that modified radical mastectomy had a significantly higher rate of seroma formation than breast-conserving surgery [7], and that conventional axillary dissection was associated with significantly more frequent seroma formation than was sentinel node biopsy [8]. We suspect that this discrepancy is caused by the relatively small number of patients in the present study and by the use of CT to identify seromas because CT can detect small seromas at subclinical levels. Mammography typically visualizes a postoperative seroma as an oval or round mass, and ultrasonographically, a seroma appears as a complex cystic mass with septations, loculations, or thick walls [2].

Despite the increasing use of chest CT in cancer patients, little information is available on the CT appearance of postoperative seroma in breast cancer patients. In the present study, we evaluated the incidence of postoperative seroma, its characteristic findings, and its longitudinal changes on sequential CT examinations. On CT, the seromas varied in size and shape, and most had homogeneous fluid density. All lesions exhibited mild peripheral rim enhancement. In serial follow-up CT images, the seromas generally diminished with time

and resolved completely at a mean 24 months after surgery in 60% of cases. However, small seromas persisted in the remaining cases.

Current guidelines recommend regular physical examinations and mammography for postoperative surveillance of breast cancer patients [3,9,10]. Advanced imaging modalities, such as CT, are not recommended in asymptomatic patients because they provide no survival or palliative advantage [11]. However, chest CT examinations are increasingly used in clinical practice for postoperative screening of breast cancer patients. Radiologists must become familiar with the characteristic chronologic appearance of the treated breast in order to identify postsurgical complications and detect local recurrence at an early stage.

This study has several limitations that warrant consideration. First, because the study was performed at a single institution, the number of included patients was small. Second, due to its retrospective nature, the detailed surgical techniques or drain methods were unknown, and the relationship between surgical and drain techniques, and the incidence of seroma could not be evaluated. However, the primary objective of this study was to evaluate the overall incidence, imaging

findings, and longitudinal changes of postoperative seroma on CT after breast cancer surgery. Further studies investigating seroma formation and various surgical and drain techniques are needed. Third, the postoperative seromas were not confirmed histopathologically. However, seroma is the most common complication after mastectomy and usually resolves within a few weeks. The seromas were managed conservatively in all patients, and in most cases, the seroma decreased in size without complication.

In summary, approximately 20% of patients developed a surgical site seroma (breast or axilla) 6 months after undergoing breast cancer surgery according to CT. However, these lesions diminished in size over time, and 60% of seromas were completely resolved 24 months postoperatively. An understanding of the CT findings of the postoperative seroma and the changes with time can prevent misdiagnosis of lesions as tumor recurrence.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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