Breast prosthetic implant-associated Squamous Cell Carcinoma: A case report and Literature Review

Zhaoyun Liu
Shandong Cancer Hospital and Institute
Chenyu Liu
University of Chicago College
Chenglong Zhao
Shandong Cancer Hospital and Institute
Qian Yu
Cleveland Clinic
Guanyu Zhang
Jining Medical University
Xinzhao Wang
Shandong Cancer Hospital and Institute
Zhi-yong Yu (drzhiyongyu@aliyun.com)
Department of Oncology, Shandong Cancer Hospital affiliated to Shandong University, Shandong Academy of Medical Sciences
https://orcid.org/0000-0002-2569-9458

Case report

Keywords: Breast neoplasm, Prostheses and implants, Carcinoma, Squamous Cell

Posted Date: January 8th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-141167/v1

Abstract

Background

Breast reconstruction is widely used for women undergoing mastectomy. Prosthetic implants have become a common technique performed for these women because of their safety, flexibility and adjustable size. There are few reports of implant-associated squamous cell carcinoma. In addition to this report, only 8 reports including 11 cases have been reported in the English literature.

Case presentation

We report the case of a patient with breast prosthetic implant-associated squamous cell carcinoma who received mastectomy and prosthetic implants 10 years ago. She was recently hospitalized with unilateral breast enlargement. Surgical pathology showed squamous cell carcinoma around the breast implant. There was no evidence of primary squamous cell carcinoma at any other anatomic site. We analysed all 11 patients with breast implant-derived squamous cell carcinoma (SCC) from a thorough literature search to identify studies. The median age of patients at SCC diagnosis was 56.8 years old. The average time from initial breast augmentation until SCC diagnosis was 21.9 years. The prognosis was poor; 4 of the 11 patients eventually progressed or died within 1 year, 3 of the 11 patients were disease free during the follow-up period, and 4 of the 11 patients were lost to follow-up. The most widespread opinion is that chronic inflammation from breast implants plays a substantial role in the disease progression of SCC.

Conclusions

We reported the rare complications associated with breast prosthetic implants and reviewed the literature. This malignancy should be taken into account in patients with breast prosthetic implants who have acute breast pain and enlargement.

Background

Breast reconstruction after mastectomy improves quality of life and patient satisfaction. Implant-based breast reconstruction is the most popular choice in post-mastectomy women, accounting for 65% of all breast reconstructions in the USA[1-3]. It is relatively easy to learn and popularize because there is no need for another incision during the operation, and it also has the advantages of quick postoperative recovery, minimal trauma, and few complications[4, 5]. It has been reported that the main complications include 4% infection, 2.5% skin flap necrosis, 2% seroma, and 3.8% capsular contracture[6, 7]. Limited evidence of cancer caused by the prosthesis has been reported. However, here, we report a case of implant-associated squamous cell carcinoma (SCC). The patient received prosthetic implants 10 years ago, and she had acute unilateral breast pain and enlargement due to tumours arising on the posterior implant.

Case Presentation

A 45-year-old woman had a past medical history of invasive ductal carcinoma status post-mastectomy and reconstruction in 2008. She was hospitalized in June 2018 and presented with left breast swelling and enlargement for 7 days. She denied recent fever, chills, nausea, vomiting or breast trauma. She also denied erythema and tenderness around the area, and she did not have nipple discharge. Upon physical examination, a round hard mass with a diameter of approximately 6 cm was palpated in the inner upper quadrant of the left breast near the sternum. Ten years ago, the patient received a modified radical mastectomy for breast cancer, followed by breast reconstruction with prosthetic implants immediately. The prosthetic implants chosen were drop-shaped silicone prostheses. Postoperatively, she recovered well without complications such as infection or skin changes. Her surgical pathology at that time showed invasive ductal carcinoma of the left breast (Table 1). She received 6 cycles of anthracyclines and docetaxel (specific drug and dose unknown), followed by tamoxifen endocrine therapy for 3 years post-chemotherapy. Follow-up surveillance with breast ultrasound and mammography during the last 6 months revealed no abnormalities.

Table 1
Pathology, IHC and adjuvant therapy of the first operation in 2008

Sentinel lymph node involvement	**0/2**
Axillary lymph node involvement	Level I 0/17; Level II 0/2
Staging	T1N0M0, Stage I
IHC	ER+, PR++, Her2 -
adjuvant therapy	6 cycles of anthracyclines and docetaxel, followed by tamoxifen endocrine therapy for 3 years post-chemotherapy.

At this visit, considering her breast cancer history and physical examination, CT and MRI were performed to evaluate the possibility of recurrence (Fig. 1). Enhanced metabolic signal changes under the left pectoralis major near the armpit and at the left supraclavicular lymph nodes suggested metastasis. Ultrasound-guided core needle biopsy of the left chest wall mass demonstrated squamous cell carcinoma. The decision was made to proceed with left chest wall mass resection, prosthesis removal and left supraclavicular lymph node biopsy. Surgical pathology of the left chest wall near the armpit mass suggested poorly differentiated SCC (Fig. 2 & Fig. 3). The morphology and immunohistochemistry showed squamous cell carcinoma (Table 2).

Table 2
Pathology and IHC of the Local-regional recurrent focus

Left chest wall mass	**Pathology: a poorly differentiated carcinoma, morphology and immunohistochemistry showed squamous cell carcinoma differentiation.** **IHC: CK5/6+,P63+、GATA-3foci+、Mammaglobin foci+、GCDFP15-、Syn-、CgA-、CK7-、TTF-1-.**
adjuvant therapy	GP regimen for 6 cycles, local and regional radiotherapy after GP chemotherapy, and capecitabine monotherapy was continued to maintain 8 cycles after radiotherapy, followed by OFS combined with oral anastrozole to date.

Postoperatively, she underwent chemotherapy with gemcitabine combined with a carboplatin (GP) regimen for 6 cycles with no significant progress. Local and regional radiotherapy treatments were given after GP chemotherapy, and capecitabine monotherapy was continued to maintain 8 cycles after radiotherapy, followed by OFS combined with oral anastrozole to date. The patient is currently in a stable condition with no significant progress until October 2020.

Discussion And Conclusions

There have been few reports of malignant tumours related to breast implants. In addition to this report, only 11 cases of implant-associated SCC have been reported since 1992. As shown in Table 3, all of these reported patients had a long history of breast silicone implantation (> 10 years), and the average time from initial breast augmentation until SCC diagnosis was 21.9 years. The median age of patients at SCC diagnosis was 56.8 years old. The tumour had an aggressive course of prognosis; 4 of the 11 patients eventually progressed or died within 1 year, 3 of the 11 patients were disease free during the follow-up period, and 4 of the 11 patients were lost to follow-up.

Table 3
Review of the literature detailing of SCC associated with breast prosthetic implants

Study	No. of Patients	Age at Diagnosis	Past medical history	Reason for Implantation	Type of Implant	Time Until SCC Diagnosis, years	Therapeutic Treatment	Outcome
Paletta et al[18], 1992	1	52	subglandular breast augmentation	Cosmetic	Silicone implant (Heyer Schulte)	15	Radical mastectomy	Disease free at 12-month follow-up
Kitchen et al[19], 1994	1	52	bilateral breast augmentation	Cosmetic	silicone implants	11	Modified radical mastectomy	Not reported
Talmor et al[20], 1995	1	70	bilateral breast augmentation	Cosmetic	liquid silicone	25	Bilateral simple mastectomy and immediate reconstruction, then a left axillary lymph node dissection and deep muscle biopsy	Not reported
Zomerlei et al[10], 2015	1	58	primary bilateral augmentation mammoplasty	Cosmetic	silicone implants	35	total mastectomy, sentinel lymph node biopsy, and complete capsulectomy	Not reported
Olsen et al[21], 2017	2	56 81	bilateral silicone breast implants a wide excision of benign breast mass followed by reconstruction	Cosmetic reconstruction	textured saline implants silicone breast implant	18 42	Mastectomy with postoperative chemotherapy and radiotherapy left mastectomy and sentinel lymph node biopsy with adjuvant radiation and chemotherapy	locoregional metastasis within 8 months Liver metastasis at 5-month follow-up and died of disease
Zhou et al[22], 2018	1	46	breast augmentation	Cosmetic	silicone gel breast implant	21	bilateral prosthesis explantation and bilateral capsulectomy with adjuvant radiation	Without clinical recurrence at 4-month follow-up
Buchanan[9] et al, 2018	1	65	breast augmentation	Cosmetic	foam-covered silastic implants (Hyer Schulte)	21	radical mastectomy and medial chest wall resection	Disease free after an 8-year follow up
Goldberg et al[23], 2020	2	40 60	breast augmentation Breast reconstruction status post benign lesion excision	Cosmetic Breast reconstruction	Smooth Saline Implants Silicone implants	11 32	Neoadjuvant chemotherapy, Patient expired before` chest wall resection Chemoradiation	Expired from malignant pleural effusions at 3-month follow-up Lost to follow-up

Study	No. of Patients	Age at Diagnosis	Past medical history	Reason for Implantation	Type of Implant	Time Until SCC Diagnosis, years	Therapeutic Treatment	Outcome
Liu et al, (current study)	1	45	modified radical mastectomy and reconstruction	Breast reconstruction	silicone prosthesis	10	left chest wall mass resection, prosthesis removal and left supraclavicular lymph node biopsy	Disease free after a 24-month follow up

Here, we present a patient with SCC that developed from an implant capsule 10 years after breast reconstruction, and she had stable condition at the 2-year follow-up after being diagnosed with SCC. Our patient presented to the clinic initially due to abnormal breast augmentation. The suspected causes included recurrent cancer and implant rupture. According to the reported literature, the chances of capsule rupture are commonly increased 10–15 years after placement because the mean lifespan of an implant is approximately 13 years[8]. Imaging studies were used to diagnose implant-associated SCC in our patient. We diagnosed this woman with implant-associated SCC by imaging and pathological examination. Further, we suggested primary SCC of the breast instead of metastasis.

Primary SCC of the breast is a rare tumour, accounting for an estimated frequency of 0.1–3.6% of all invasive breast cancers with poor clinical outcomes[9–11]. Skin or nipple cancer and metastasis sites should be excluded when SCC is diagnosed[12]. The clinical symptoms of implant-associated SCC are likely to be a primary mammary tumour, and the histological appearance is important to make the diagnosis[13, 14]. In this report, the woman had no histologic indications of primary breast cancer, as she had a mastectomy 10 years ago. The cancer was located around the squamous epithelialized implant capsules and involved the chest wall through the capsule. Moreover, there was no clinical or radiologic evidence of cutaneous or distant invasive squamous cell carcinoma.

The pathogenesis of breast prosthetic implant-associated SCC is not clear. Metaplastic squamous epithelialization of the capsular lining or entrapment of skin or adnexal elements has been acknowledged[15]. The most common histological characterization in implant capsules was collagen fibre alignment and fibrous capsule[16, 17]. A silicone implant leads to the formation of a nonadherent surface, and a textured and rough surface may stimulate immunity, therefore enhancing the risk of an inflammatory response[8]. Squamous epithelialization metaplasia may act as a protective mechanism against chronic injury from breast implant placement. In this report, the woman had no evidence of chronic infection.

In conclusion, patients with breast prosthetic implant-associated SCC suffer from acute breast pain and enlargement excluding malignancy. We should take this seriously in patients who present with unilateral breast enlargement after prosthetic implants. This report helps us to identify this rare tumour of implant-associated SCC.

Abbreviations

SCC, squamous cell carcinoma.

Declarations

Availability of Data and Materials

All the original data supporting our research are described in this article.

Funding

This work was funded by the grants from the Natural Science Foundation of Shandong Province (ZR2019MH109).

Authors' contributions section

All authors contributed to the study conception and design. The data collection was performed by Chenyu Liu, Chenglong Zhao, Qian Yu, Guanyu Zhang, the analysis was performed by Xinzhao Wang, Zhiyong Yu. The first draft of the manuscript was written by Zhaoyun Liu, and all authors commented on the previous versions of the manuscript. All authors read and approved the final manuscript.

Ethics statement

This study obtained approval from the Ethics Committee of the Shandong Cancer Hospital and Institute and was approved to meet the standard of clinical practice. The consent was received from the study participants and the guidelines outlined in the Declaration of Helsinki were followed.

Competing interests

The authors declare that they have no competing interests.

Acknowledgements

We are thankful to the patient for her cooperation which was of utmost importance in the study.

References

1. Zingaretti N, Galvano F, Vittorini P, De Francesco F, Almesberger D, Riccio M, Vaienti L, Parodi PC: Smooth Prosthesis: Our Experience and Current State of Art in the Use of Smooth Sub-muscular Silicone Gel Breast Implants. Aesthetic Plast Surg.2019; 43(6):1454-1466.
2. Cemal Y, Albornoz CR, Disa JJ, McCarthy CM, Mehrara BJ, Pusic AL, Cordeiro PG, Matros E: A paradigm shift in U.S. breast reconstruction: Part 2. The influence of changing mastectomy patterns on reconstructive rate and method. Plast Reconstr Surg.2013; 131(3):320e-326e.
3. Albornoz CR, Bach PB, Mehrara BJ, Disa JJ, Pusic AL, McCarthy CM, Cordeiro PG, Matros E: A paradigm shift in U.S. Breast reconstruction: increasing implant rates. Plast Reconstr Surg.2013; 131(1):15-23.
4. Hirsch EM, Seth AK, Dumanian GA, Kim JY, Mustoe TA, Galiano RD, Fine NA: Outcomes of tissue expander/implant breast reconstruction in the setting of prereconstruction radiation. Plast Reconstr Surg.2012; 129(2):354-361.
5. Bertozzi N, Pesce M, Santi P, Raposio E: One-Stage Immediate Breast Reconstruction: A Concise Review. Biomed Res Int.2017; 2017:6486859.
6. Nahabedian MY: Innovations and advancements with prosthetic breast reconstruction. Breast J.2018; 24(4):586-591.
7. Vardanian AJ, Clayton JL, Roostaeian J, Shirvanian V, Da Lio A, Lipa JE, Crisera C, Festekjian JH: Comparison of implant-based immediate breast reconstruction with and without acellular dermal matrix. Plast Reconstr Surg.2011; 128(5):403e-410e.
8. Seiler SJ, Sharma PB, Hayes JC, Ganti R, Mootz AR, Eads ED, Teotia SS, Evans WP: Multimodality Imaging-based Evaluation of Single-Lumen Silicone Breast Implants for Rupture. Radiographics.2017; 37(2):366-382.
9. Buchanan PJ, Chopra VK, Walker KL, Rudolph R, Greco RJ: Primary Squamous Cell Carcinoma Arising From a Breast Implant Capsule: A Case Report and Review of the Literature. Aesthet Surg J.2018; 38(7).
10. Zomerlei TA, Samarghandi A, Terando AM: Primary Squamous Cell Carcinoma Arising from a Breast Implant Capsule. Plast Reconstr Surg Glob Open.2015; 3(12):e586.
11. Morgan E, Suresh A, Ganju A, Stover DG, Wesolowski R, Sardesai S, Noonan A, Reinbolt R, VanDeusen J, Williams N *et al*: Assessment of outcomes and novel immune biomarkers in metaplastic breast cancer: a single institution retrospective study. World J Surg Oncol.2020; 18(1):11.
12. Ramos V, Fraga J, Simoes T, Figueiredo Dias M: Intracystic Primary Squamous Cell Carcinoma of the Breast: A Challenging Diagnosis. Case Rep Obstet Gynecol.2016; 2016:6081634.
13. Mirrielees JA, Kapur JH, Szalkucki LM, Harter JM, Salkowski LR, Strigel RM, Traynor AM, Wilke LG: Metastasis of primary lung carcinoma to the breast: a systematic review of the literature. J Surg Res.2014; 188(2):419-431.
14. Aitelhaj M, Khoyaali SL, Boukir A, Elkabous M, Abahssain H, Mrabti H, El Khannoussi B, Errihani H: Breast and splenic metastases of squamous cell carcinoma from the uterine cervix: a case report. J Med Case Rep.2014; 8:359.
15. Frenkiel BA, Temple-Smith P, de Kretser D, Southwick GJ: Follistatin and the Breast Implant Capsule. Plast Reconstr Surg Glob Open.2017; 5(3):e1258.
16. Bui JM, Perry T, Ren CD, Nofrey B, Teitelbaum S, Van Epps DE: Histological characterization of human breast implant capsules. Aesthetic Plast Surg.2015; 39(3):306-315.
17. Jimenez-Heffernan JA, Barcena C, Munoz-Hernandez P: Cytological features of breast peri-implant papillary synovial metaplasia. Diagn Cytopathol.2018; 46(9):769-771.
18. Paletta C, Paletta FX, Jr., Paletta FX, Sr.: Squamous cell carcinoma following breast augmentation. Ann Plast Surg.1992; 29(5):425-429; discussion 429-432.

19. Kitchen SB, Paletta CE, Shehadi SI, Bauer WC: Epithelialization of the lining of a breast implant capsule. Possible origins of squamous cell carcinoma associated with a breast implant capsule. Cancer.1994; 73(5):1449-1452.
20. Talmor M, Rothaus KO, Shannahan E, Cortese AF, Hoffman LA: Squamous cell carcinoma of the breast after augmentation with liquid silicone injection. Ann Plast Surg.1995; 34(6):619-623.
21. Olsen DL, Keeney GL, Chen B, Visscher DW, Carter JM: Breast implant capsule-associated squamous cell carcinoma: a report of 2 cases. Hum Pathol.2017; 67:94-100.
22. Zhou YM, Chaudhry HE, Shah A, Andrews J: Breast Squamous Cell Carcinoma Following Breast Augmentation. Cureus.2018; 10(10):e3405.
23. Goldberg MT, Llaneras J, Willson TD, Boyd JB, Venegas RJ, Dauphine C, Kalantari BN: Squamous Cell Carcinoma Arising in Breast Implant Capsules. Ann Plast Surg.2020.

Figures

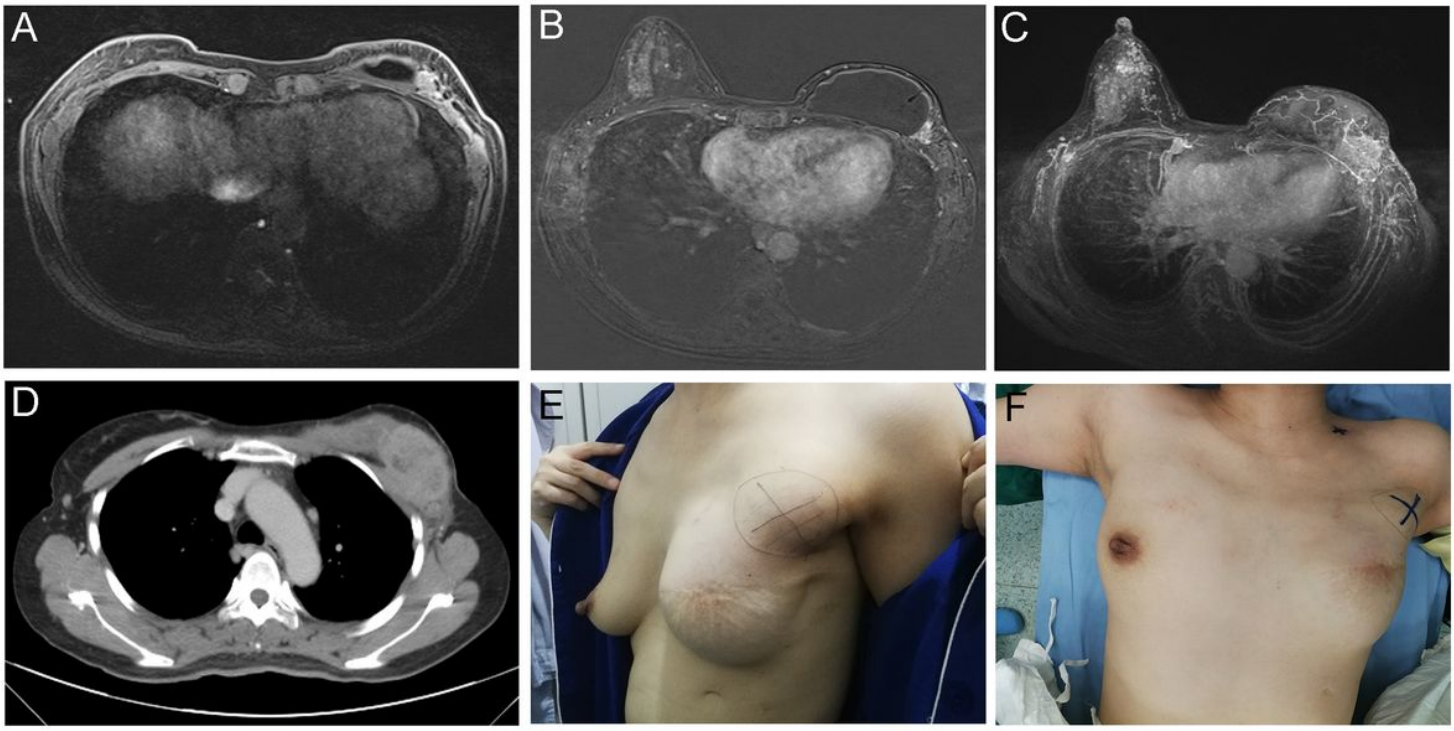

Figure 1

The photoshop image of the women 10 years later after the mastectomy and prosthetic implant. MRI and CT (A-D), preoperative view of swollen left breast (E, F).

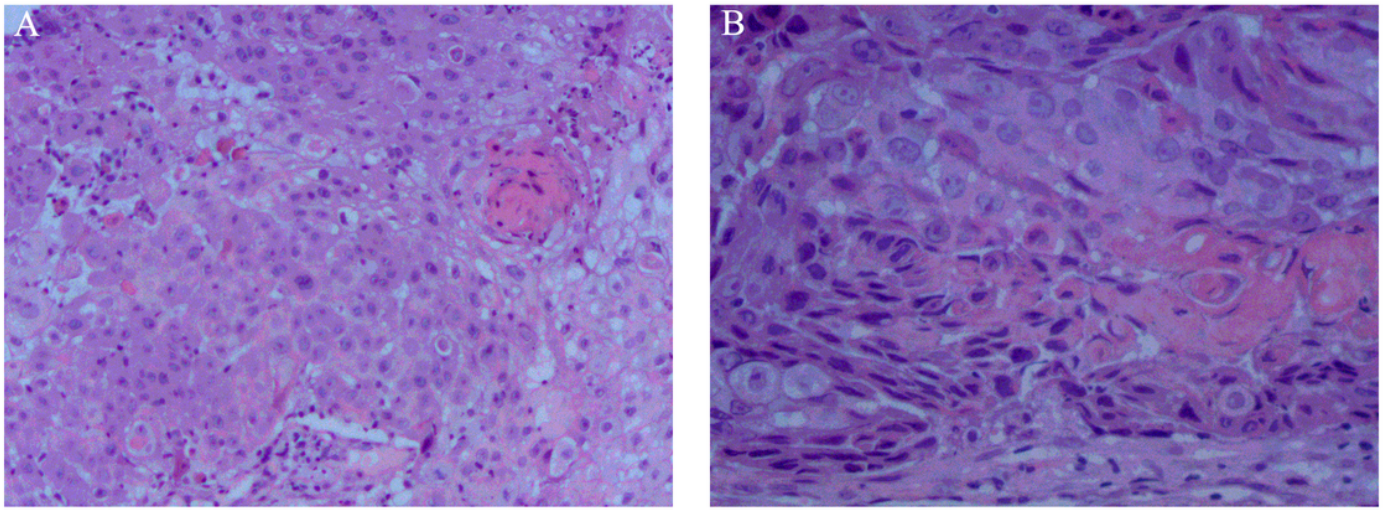

Figure 2

Photomicrographs of SCC, a Light microscopy sections with hematoxylin and eosin staining demonstrating markedly kKeratin pearls (HE) consistent with SCC (A 200×, B 400×).

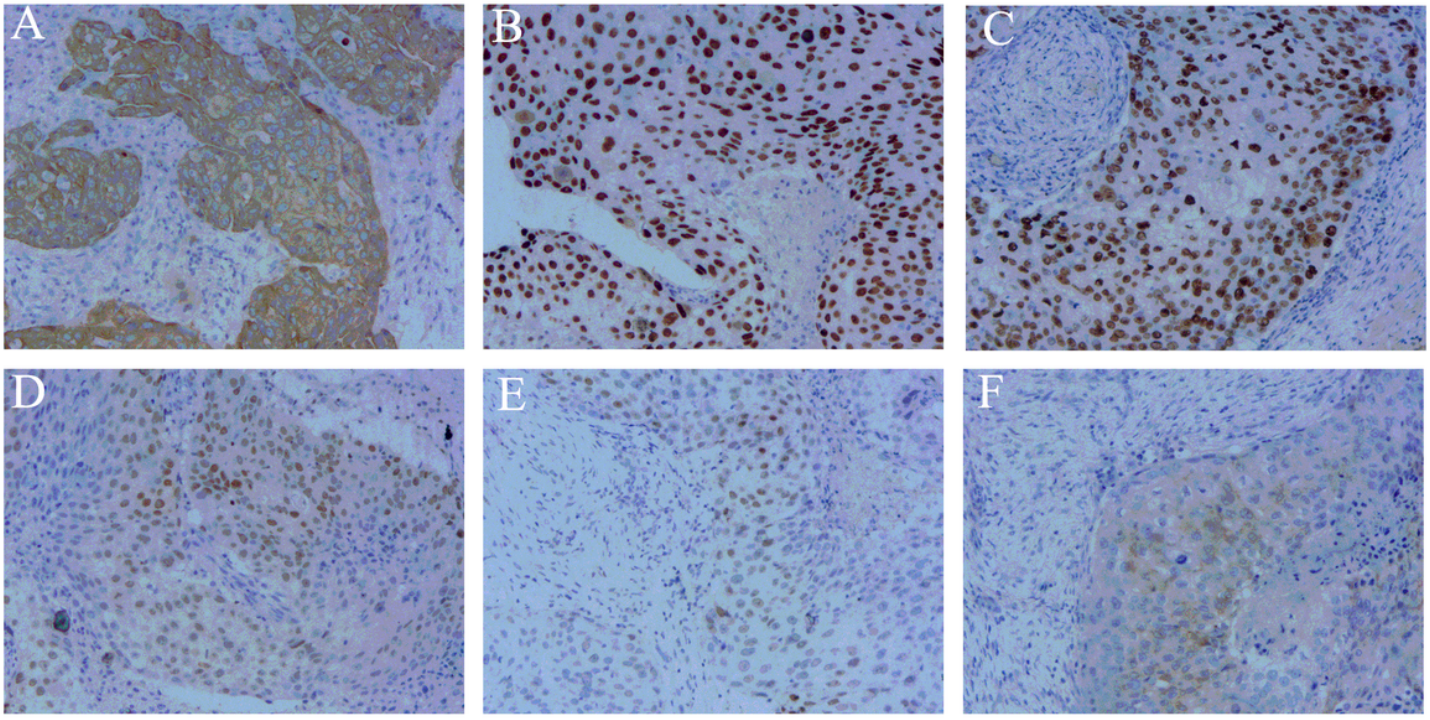

Figure 3

Photomicrographs of immunohistochemistry: CK5/6 (a), P40 (b), P63 (c), GATA-3 foci (d), ER (e), Mammaglobin foci (f), IHC, ×200.