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Observational Study

Breast-conserving surgery and sentinel lymph node biopsy for breast cancer and their correlation with the expression of polyligand proteoglycan-1

Fu-Ming Li, Dan-Ying Xu, Qi Xu, Yan Yuan

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Abstract

BACKGROUND

Breast cancer is a malignant tumor with an unclear etiology and is the most common malignant tumor in women. Surgery is the main clinical treatment for breast cancer. Although traditional total mastectomy combined with axillary lymph node dissection is effective, it can result in shoulder dysfunction, especially in middle-aged and elderly patients with breast cancer with weak constitution and other underlying diseases. Furthermore, the postoperative quality of life is poor.

AIM

To assess breast-conserving surgery and sentinel lymph node biopsy for breast cancer treatment and their correlation with polyligand proteoglycan-1.

METHODS

Overall, 80 patients with breast cancer treated in our hospital from January 2021 to July 2021 were retrospectively selected and divided into an observation group ($n = 44$) and control group ($n = 36$) according to the treatment plan. The observation group was treated with breast-conserving surgery and sentinel lymph node biopsy, and the control group was treated with total breast resection. Simultaneously, immunohistochemical staining was used to detect the expression of syndecan-1 (SDC-1) in the lesions, and its relationship with clinicopathological findings was analyzed.

RESULTS

Intraoperative blood loss, operation time, and hospital stay in the observation group were 65.51 ± 9.94 mL, 65.59 ± 9.40 min, and 14.80 ± 3.03 d, respectively, which were significantly lower than those in the control group ($P < 0.05$). The incidence of postoperative complications in the observation group was 11.36%,

which was significantly lower than that in the control group ($P < 0.05$). The positive expression rate of SDC-1 in the observation group was 25.00%, and there was no significant difference between the groups ($P > 0.05$). The positive expression rate of SDC-1 in patients with American Joint Committee on Cancer (AJCC) stage II was 14.29%, which was significantly lower than that in patients with AJCC stage I ($P < 0.05$). The positive expression of SDC-1 had no significant relationship with age, course of disease, site, tissue type, and treatment plan ($P > 0.05$).

CONCLUSION

Breast preservation surgery and sentinel lymph node biopsy for breast cancer treatment have fewer complications and quicker recovery than those treated with total breast resection. Low SDC-1 expression in breast cancer lesions is related to AJCC staging.

Key Words: Breast preservation; Sentinel lymph node biopsy; Breast cancer; Clinical effectiveness; Polyligand proteoglycan-1

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Core Tip: Breast preservation and sentinel lymph node biopsy has shown to have a good treatment effect in patients with breast cancer, especially in older patients, as well as the significant advantage of guaranteed postoperative quality of life for patients. Polyligand proteoglycan-1 is used as a cell surface mucin polysaccharide, which is also a kind of biological macromolecular protein closely associated with tumorigenesis. In this study, we explored the relationship between breast cancer treatment and polyligand proteoglycan-1 through this study.

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INTRODUCTION

In recent years, breast preservation and sentinel lymph node biopsy has shown to have a good treatment effect in patients with breast cancer, especially in older patients, as well as the significant advantage of guaranteed postoperative quality of life for patients[1-4]. The procedure is more popular in developed countries, but it has not been widely performed in China. Further exploration of the occurrence and developmental mechanism of breast cancer at the molecular level and biomarkers with high specificity and sensitivity can provide new therapeutic targets for the treatment of breast cancer [5]. Polyligand proteoglycan-1 [syndecan-1 (SDC-1)] is used as a cell surface mucin polysaccharide, which is also a kind of biological macromolecular protein closely associated with tumorigenesis; it participates in the regulation of various functions, including lymphocyte accumulation, immunomodulation, and cell matrix regulation, and is closely related to the progress of various malignant tumors[6].

The purpose of this study was to further confirm the effectiveness of breast preservation and sentinel lymph node biopsy and explore the efficacy of different treatment methods and their correlation with SDC-1 expression.

MATERIALS AND METHODS

Baseline data

A total of 80 patients with breast cancer treated in our hospital from January 2021 to July 2021 were retrospectively selected. The inclusion criteria for patients were as follows: (1) confirmation of breast cancer by pathology; (2) classified according to American Joint Committee on Cancer (AJCC) stage I-II; (3) single lesion with a diameter < 3 cm and the distance from tumor edge to areola edge ≥ 2 cm; and (4) complete clinical follow-up data. The exclusion criteria were as follows: (1) preoperative anti-tumor therapy such as radiotherapy and chemotherapy; and (2) breast cancer combined with autoimmune diseases, blood system diseases, and other serious diseases. Patients were divided into an observation group ($n = 44$) and control group ($n = 36$) according to the treatment plan. A comparison of general clinical data between the two groups is shown in Table 1. This study was approved by the hospital

Table 1 Comparison of general clinical data between the observation group and the control group, *n* (%)

Group	Cases	Age (yr)	Course of the disease (mo)	AJCC stage		Site		Tissue types	
				I	II	Outer quadrant	Non outer quadrant	Invasive ductal carcinoma	Others
Observation group	44	51.03 ± 12.11	11.06 ± 3.35	26 (59.09)	18 (40.91)	26 (59.09)	18 (40.91)	33 (75.00)	11 (25.00)
Control group	36	49.10 ± 11.45	10.42 ± 4.03	19 (52.78)	17 (47.22)	21 (58.33)	15 (41.67)	24 (66.67)	12 (33.33)
<i>t</i> / χ^2		0.727	0.776	0.321		0.878		0.671	
<i>P</i> value		0.470	0.440	0.571		0.349		0.413	

AJCC: American Joint Committee on Cancer.

ethics committee.

Treatment and follow-up method

Total breast resection was performed in the control group. The patients were placed in supine position, under general anesthesia, with both breasts exposed and tumor boundaries marked. The nipple, areola, and skin and breast tissue 3 cm from the tumor edge were routinely removed. Axillary lymph nodes were dissected, and all lymph nodes from the leading edge of the latissimus dorsi muscle to the medial side of the pectoralis minor muscle were removed. Drainage tubes were placed after surgery and surgical incision was closed.

Breast preservation and sentinel lymph node biopsy was performed in the observation group. For breast preservation surgery, patients were administered general anesthesia, and 3 mL 1% methylene blue was injected subcutaneously into the areola. Normal tissues approximately 2 cm from the tumor were removed, and quick freezing was performed for pathological examination. If the margin was positive, total mastectomy was performed. If the results of margin examination were negative, breast preservation surgery was performed. For sentinel lymph node biopsy, an axillary and mammary fold were selected as surgical approaches, a longitudinal incision was made, subcutaneous tissue was cut, and the first blue staining lymph node was searched for in the lymphatic vessels. After the sentinel lymph node was removed, it was quickly frozen for pathological examination. If the test result was positive, axillary lymph node dissection was performed; if the test results were negative, the incision was closed, and the operation was completed.

Immunohistochemical testing method

The surgically resected tissue was fixed with 10% formaldehyde for 24 to 48 h and then embedded in paraffin. The paraffin sample was cut into 4 consecutive tissue sections with a thickness of approximately 4 mm and baked at 60°C for 3 h. Conventional dewaxing was performed, 3% H₂O₂ was added for 10 min, and then incubated at room temperature. The samples were washed with phosphate-buffered saline (PBS) 3 times for 3 min each, repaired with citric acid solution, washed with PBS 3 times for 3 min each, and incubated overnight with the primary antibody (anti-SDC-1). Samples were washed with PBS 3 times for 3 min each, polymer enhancer was added, incubated at room temperature for 20 min, washed with PBS 3 times for 3 min each, enzyme-labeled anti-mouse polymer was added, and incubated at room temperature for 30 min. Samples were washed with diaminobenzidine chromogenic water, dyed with hematoxylin, and sealed by conventional dehydration. The immunohistochemistry kit was purchased from Beijing Zhongshan Biological Products Co., LTD (Beijing, China).

Statistical analysis

SPSS 22.0 software (IBM, Armonk, NY) was used for data analyses. Normally distributed data are expressed as means with standard deviations. The *t*-test was used for comparison between groups. Count data are expressed as *n* (%), and comparisons between groups was performed by χ^2 test. The inspection level was set at $\alpha = 0.05$.

RESULTS

Comparison of operation-related indices between groups

Intraoperative blood loss, operation time, and hospital stay in the observation group were significantly lower than those of the control group ($P < 0.05$) (Table 2).

Table 2 Comparison of operation related indexes between observation group and control group

Group	Cases	Intraoperative blood loss (mL)	Operation time (min)	Hospital stay (d)
Observation group	44	65.51 ± 9.94	65.59 ± 9.40	14.80 ± 3.03
Control group	36	120.17 ± 13.35	105.51 ± 8.81	24.41 ± 3.80
<i>t</i>		-20.977	-19.435	-12.587
<i>P</i> value		0.000	0.000	0.000

Comparison of complications between groups

The incidence of postoperative complications in the observation group was significantly lower than that of the control group ($P < 0.05$) (Table 3).

Comparison of SDC-1 expression in lesions between groups

There was no significant difference in SDC-1 expression between groups ($P > 0.05$) (Table 4).

Relationship between SDC-1 expression and clinicopathological characteristics of breast cancer

The positive expression rate of SDC-1 in patients with AJCC stage II was 11.29%, which was significantly lower than that for AJCC stage I ($P < 0.05$). There was no relationship between SDC-1 positivity and age, disease course, site, tissue type, or treatment plan ($P > 0.05$) (Table 5, Figure 1).

DISCUSSION

Total mastectomy combined with axillary lymph node dissection is the most common treatment for patients with breast cancer, but it is poorly tolerated in some patients as there are many complications after surgery, which increase the risk of surgical site infection. Recent advances in medical and health technology have led to the development of breast-conserving surgery. After surgical resection of pathological tissues, sentinel lymph node biopsy should be performed on patients, and qualitative pathological examinations should be performed after lymphatic tissue resection. If the results are positive, mastectomy is still needed to prevent recurrence, but most patients with a negative pathological examination can achieve breast conservation[7-9].

The amount of intraoperative blood loss, operation time, and hospital stay in the observation group were significantly lower than those in the control group ($P < 0.05$). This may be because sentinel lymph node biopsy can predict lymph node metastasis and reduce axillary lymph node dissection treatment, thus slowing down the spread of cancer cells and improving the therapeutic effect. The focus of breast preservation surgery is to preserve the appearance and function of the patient's breast, minimize the scope of surgical resection, and reduce intraoperative blood loss. As of 2021, the incidence of postoperative complications in the observation group was significantly lower than that in the control group ($P < 0.05$), and there was no significant difference in postoperative recurrence rate between the two groups, which is consistent with the results of previous studies[10]. Other studies[11-13] have confirmed that for patients with stage I-II breast cancer, combined breast preservation surgery and sentinel lymph node biopsy can reduce the occurrence of postoperative complications, accelerate recovery, contribute to anti-tumor immune function, and play a role in preventing the recurrence of advanced tumors. However, there was no significant difference in the postoperative recurrence rate between the two treatments in this study, which may be due to the small sample size.

As can be seen from the results of this study, the advantages of breast-conserving surgery combined with sentinel lymph node biopsy in the treatment of early breast cancer are evident in two aspects. First, preoperative sentinel lymph node biopsy can accurately determine whether axillary lymph node metastasis occurs. It is helpful to detect metastatic cancer cells early and take effective intervention measures in a timely manner to prevent the spread of cancer cells. Second, compared with radical surgery, breast-conserving surgery has a smaller resection area and causes less trauma to the body. Tumor metastasis can be controlled while preserving the shape of the patient's breast as much as possible, resulting in high patient satisfaction.

SDC-1 is closely related to malignant tumors, can promote the occurrence and development of some tumors, and may promote the division and proliferation of tumor cells as well as tumor angiogenesis [14]. SDC-1 can be expressed on the surface of tumor cells from a variety of sources. After malignant transformation of a variety of tumors, SDC-1 expression on tumor cell membranes will also change[15]. SDC-1, a member of the transmembrane mucin family of adhesive molecule integrin, is mainly expressed in mammalian epithelial cells, activates corresponding cell signal transduction pathways, and exerts biological effects through a series of ligands including its own heparin sulfate side-chain and cell adhesion molecules, matrix components, growth factors, enzymes, and enzyme inhibitors[16,17]. The

Table 3 Comparison of complications between the observation group and the control group, *n* (%)

Groups	Cases	Complication				Total
		Hemorrhage	Effusion	Upper extremity edema	Other	
Observation group	44	1 (2.27)	2 (4.55)	1 (2.27)	1 (2.27)	5 (11.36)
Control group	36	3 (8.33)	3 (8.33)	6 (16.67)	4 (11.11)	16 (44.44)
χ^2						11.192
<i>P</i> value						0.000

Table 4 Comparison of polyligand proteoglycan-1 expression in lesions of observation group and control group, *n* (%)

Group	Cases	Positive expression rate of SDC-1	χ^2	<i>P</i> value
Observation group	44	11 (25.00)	0.084	0.771
Control group	36	8 (22.22)		

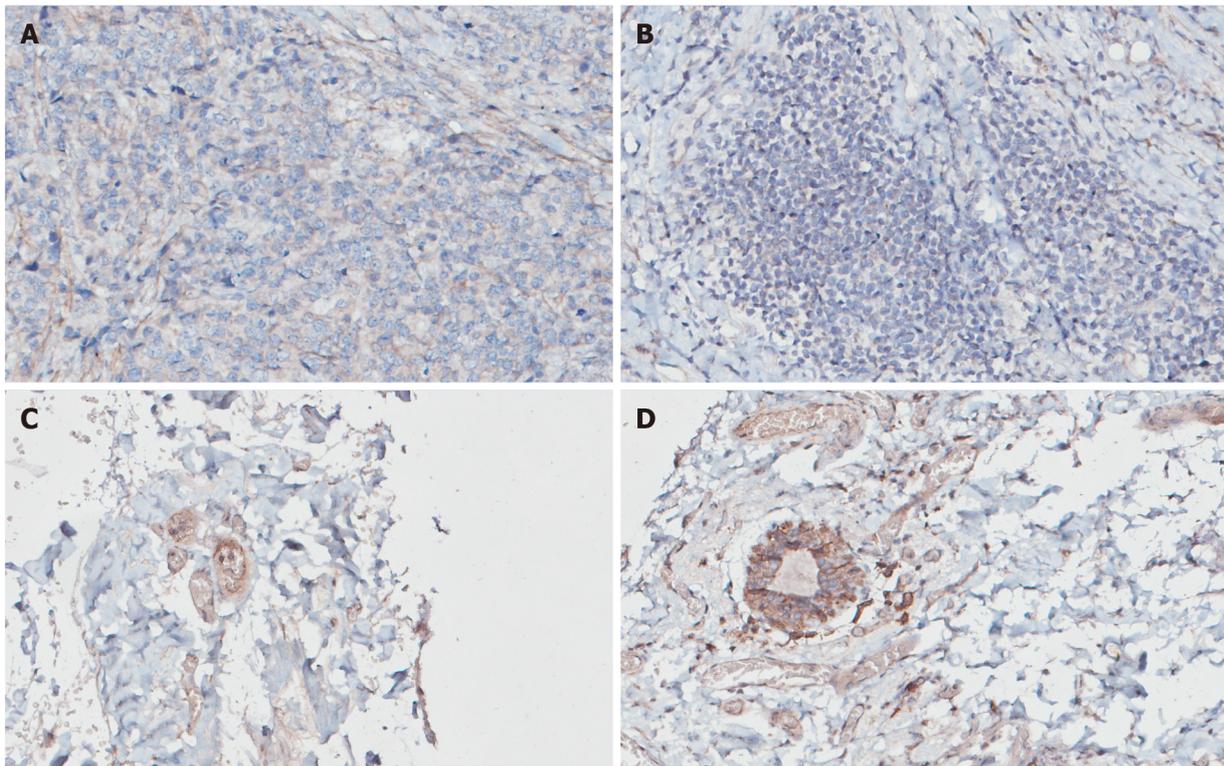
SDC-1: Polyligand proteoglycan-1 (syndecan-1).

Table 5 Relationship between polyligand proteoglycan-1 expression and clinicopathological characteristics of breast cancer, *n* (%)

Clinicopathological features	Cases	Positive expression rate of SDC-1	χ^2	<i>P</i> value
Age (yr)			0.225	0.635
< 50	30	8 (26.67)		
≥ 50	50	11 (22.00)		
Course of the disease			0.133	0.716
< 12 mo	35	9 (25.71)		
≥ 12 mo	45	2 (5.71)		
AJCC stage			5.824	0.016
I	45	17 (37.78)		
II	35	5 (14.29)		
Site			0.008	0.931
Outer quadrant	47	11 (23.40)		
Non outer quadrant	33	8 (24.24)		
Tissue type			0.097	0.755
Invasive ductal carcinoma	57	13 (22.81)		
Others	23	6 (26.09)		
Treatment plan			0.084	0.771
Breast conserving surgery plus sentinel lymph node biopsy	44	11 (25.00)		
Total mastectomy	36	8 (22.22)		

SDC-1: Polyligand proteoglycan-1 (syndecan-1); AJCC: American Joint Committee on Cancer.

results of this study showed that there was no significant difference in the positive expression rate of SDC-1 between groups ($P > 0.05$), and the positive expression rate of SDC-1 in patients with AJCC stage II and recurrence was significantly lower than that in patients with AJCC stage I and without recurrence ($P < 0.05$). These results suggest that SDC-1 may be involved in the occurrence and development of breast cancer. SDC-1 may be closely related to the occurrence and development of breast cancer and the severity of disease development. This may be because it can promote angiogenesis around lesions and promote the further development of breast cancer through invasion and spreading, causing damage to



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Figure 1 Immunohistochemical staining. A, B: No obvious polyligand proteoglycan-1 [syndecan-1 (SDC-1)] expression was found in cell membrane of the breast cancer cells; C, D: Normal mammary epithelial cells.

adjacent tissues and organs. High expression of SDC-1 and angiogenesis is the key to the success of lesion transplant factors, which play an important role in the pathogenesis of breast cancer. Therefore, SDC-1 can be considered as a new diagnostic and treatment indicator of mammary cancer, which needs to be further studied.

In recent years, the incidence of breast cancer has increased significantly, and its clinical treatment is more complicated. Although individualized and standardized treatment strategies have been widely advocated, problems such as a high recurrence rate, many complications, and unsatisfactory long-term efficacy still exist[18-20]. Therefore, new methods of diagnosis and treatment are urgently needed. Currently, the relationship between SDC-1 expression and patients with breast cancer before and after surgery has not been indicated in clinical studies. In this study, breast preservation surgery and sentinel lymph node biopsy were performed on patients, immunohistochemistry was used to detect the positive expression of SDC-1, and the relationship between SDC-1 and clinicopathological factors of breast cancer was analyzed. These findings can provide a new basis for early diagnosis, treatment, effective control of the recurrence of breast cancer, and relevant reference values.

CONCLUSION

Breast preservation and sentinel lymph node biopsy for the treatment of breast cancer has a good clinical effect, including fewer complications and quicker recovery than total breast resection. Low SDC-1 expression in breast cancer lesions is related to AJCC staging.

ARTICLE HIGHLIGHTS

Research background

Breast cancer is a malignant tumor with an unclear etiology and is the most common malignant tumor in women.

Research motivation

Polyligand proteoglycan-1 [syndecan-1 (SDC-1)] participates in the regulation of various functions, including lymphocyte accumulation, immunomodulation, and cell matrix regulation, and is closely

related to the progress of various malignant tumors.

Research objectives

We explored the efficacy of different treatment methods and their correlation with SDC-1 expression.

Research methods

We selected 80 patients with breast cancer and divided into an observation group ($n = 44$) and control group ($n = 36$) according to the treatment plan.

Research results

The positive expression rate of SDC-1 in patients with American Joint Committee on Cancer (AJCC) stage II was 11.29%, which was significantly lower than that for AJCC stage I.

Research conclusions

Low SDC-1 expression in breast cancer lesions is related to AJCC staging.

Research perspectives

We need further multicenter studies with large samples to confirm this study.

FOOTNOTES

Author contributions: Li FM and Xu DY contributed equally to this work and are considered co-first authors; Li FM and Xu DY analyzed and interpreted data and wrote the manuscript; Xu Q and Yuan Y drafted the manuscript and collected the data; Li FM designed the study and revised the manuscript for important intellectual content.

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