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Does oncoplastic breast-conserving surgery cause unnecessary additional evaluations?

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Abstract. – OBJECTIVE: Patients who have undergone breast-conserving surgery may experience fear of recurrence. Post-operative granulation tissue and fat necrosis are common issues for these patients. As a result, additional examinations may increase, which can entail increased costs and stress for patients. In this study, if oncoplastic breast-conserving surgery causes additional imaging and unnecessary additional evaluations.

PATIENTS AND METHODS: We retrospectively analyzed data from 432 patients who had undergone breast-conserving surgery in the same surgical unit between 2013 and 2017. We separated the patients into two main groups: Group 1 were those operated with conservative breast-conserving surgery, while Group 2 had operations using oncoplastic breast-conserving surgery techniques. The two groups were compared in terms of post-operative radiological examinations, suspected radiological findings, and biopsy needs.

RESULTS: There were 203 patients in Group 1 and 229 in Group 2. The median follow-up time was 66 months (range 12-109). Additional mammography use was higher in the second group (p=0.003). However, the two groups had no statistical differences for additional imaging and biopsy needs in general (p=0.138). Sixty-two patients (14.3%) had biopsies with suspicious radiological findings (15.8% *vs.* 13.1%). Eight (12.8%) of these patients had malignant results. There were local recurrences in six patients, one in the first group and five in the second group (p=0.084).

CONCLUSIONS: Oncoplastic breast-conserving surgery may increase post-operative mammography use. However, there is no statistical difference between the two groups for either additional imaging in total or in biopsy needs.

Key Words:
Breast-conserving surgery, Breast cancer, Oncoplastic breast surgery, Additional imaging, Follow-up, Unnecessary procedures.

Introduction

Oncoplastic breast-conserving surgery (OPS) is an effective surgical technique with improved cosmetic outcomes for breast cancer patients[1]. This technique has become quite widespread worldwide[2].

The OPS technique allows wider excisions for breast tumors to be removed with negative surgical margins while maintaining local control[3]. The purpose of breast-conserving surgery is increasingly shifting to cosmetic outcomes and patient satisfaction. OPS techniques allow large tumors in large breasts to be removed with improved cosmetic results. The volume of the breasts can be reduced and reshaped to allow for the use of adjuvant radiation therapy (RT) for ptotic breasts. Therefore, one of the most important advantages of OPS is that post-operative adjuvant RT planning is more manageable, and treatment with low doses can be maintained for patients with macromastia[4]. With the widespread use of the OPS techniques, mastectomy rates have decreased even for patients who had neoadjuvant chemotherapy[5].

Generally, OPS includes two types of techniques. Volume displacement techniques involve glandular or dermoglandular transposition after resection, while volume replacement techniques involve autologous tissue or implants.

The surgeon uses volume displacement techniques to reshape the breast by removing glandular tissue after wide excisions. After surgery, this often leads to the development of fat necrosis and the formation of granulation tissue. As a result, the most common concerns about OPS are the possible difficulties in patient follow-up. The post-operative granulation tissue and fat necrosis may cause misdiagnoses, and the number of additional examinations may increase, which would cause patients to face increased costs and more stress[6].

We designed this study to answer whether OPS has a disadvantage in long-term follow-up for the difficulties in imaging.

Patients and Methods

This is a retrospective cohort study, which analyzes post-operative additional imaging and biopsy

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needs for breast cancer patients. Data from 441 patients who underwent breast-conserving surgery in the same surgical unit between 2013 and 2017 were analyzed retrospectively.

Patients were divided into two main groups: those operated with conservative breast-conserving surgery (BCS) (Group 1) and those treated with oncoplastic breast-conserving surgery techniques (OPS) (Group 2). BCS is defined as only the tumor excision process, whereas OPS fills the gap after excision by glandular tissue transposition (volume displacement techniques).

Patients who underwent breast-conserving surgery in our hospital between 2013 and 2017 and were followed up for at least one year after surgery were included in the study.

Patients who underwent neoadjuvant chemotherapy and had a follow-up period of less than one year were excluded from the research. Out of 441 patients, 9 were excluded due to incomplete data.

The data were collected from the hospital database and operating room records. Patient and tumor characteristics (age, pathological subtypes, receptor status, pathological tumor stage), surgical technique performed, and adjuvant treatments were recorded. The operation date and the date of the last follow-up were noted. Follow-up intervals, radiological examination reports and findings, recommended biopsies, and pathological results were also recorded.

In addition to the annual mammography (MG) or ultrasonography (US) examinations for the follow-up, additional imaging performed for suspicious findings was determined. Additional radiological examination types and dates were noted. Moreover, magnetic resonance imaging (MRI) scans were also determined, and BI-RADS scores were noted, as well as iopsy procedures, types, and pathological results for any suspicious findings.

The groups were compared for post-operative radiological examinations, suspected radiological findings, and biopsy needs. Also, descriptive analyses were made as to the age and tumor characteristics of all patients.

Statistical Analysis

The categorical variables obtained within the scope of the study were summarized as frequency (percentage), numerical variables such as mean and standard deviation (95% confidence interval), or median (quartile 1 and quartile 3) after necessary assumption tests. Pearson's Chi-squared test was used for comparing categorical variables in two independent groups (BCS and OPS), and independent samples *t*-test or Mann-Whitney U test was used to compare numerical variables. Statistical analysis was performed using IBM SPSS software version 25 (IBM Corp., Armonk, NY, USA). The frequencies of the examined parameters (procedure, operation, etc.) were given using cross tables according to the groups. The difference between the groups regarding these frequencies was compared using Pearson's Chi-squared test. Cases with a *p*-value below 0.05 were considered statistically significant results.

Results

The medical records of 441 patients who underwent breast-conserving surgery from 2013 to 2017 were retrospectively analyzed, with nine patients excluded due to incomplete data. There were 203 patients in the BCS Group and 229 in the OPS Group. The median follow-up time was 66 months (range 12-109). The median age was 51 years (range 19-86), and all patients were women (Table I). Demographic characteristics and median follow-up times were similar in both groups.

Patient and tumor characteristics are summarized in Table II. Applied OPS techniques were inferior (91 patients) and superior (28 patients) pedicle wise-pattern mammaplasty, upper-outer quadrantectomy-racket excision

Table I. Demographic characteristics.

		Surgical technique		
	Total	Group 1 BCS	Group 2 OPS	*p*
Age (years)	51.33±10.84 (50.29-52.36)	51.7±10.3 (50.2-53.1)	51.0±11.3 (49.5-52.5)	0.599*
Follow-up time (month)	66 (58-80)	70 (59-82)	63 (57-77)	0.014**

*Independent sample *t*-test, **Mann-Whitney U test. BCS: conservative breast-conserving surgery, OPS: oncoplastic breast-conserving surgery. Data were summarized as frequency (column percentage), mean±standard deviation with a 95% confidence interval, or median (Quartile 1- Quartile 3).

Table II. Pathological findings, tumor and treatment characteristics.

	Total n (%)	Group 1 BCS n (%)	Group 2 OPS n (%)	*p*-value
PATHOLOGY				
DCIS	28 (6.5%)	15 (7.4%)	13 (5.7%)	0.238
IDC	354 (81.9%)	171 (84.2%)	183 (79.9%)	
ILC	18 (4.2%)	4 (2.0%)	14 (6.1%)	
Mixed	16 (3.7%)	6 (3.0%)	10 (4.4%)	
Others	16 (3.7%)	7 (3.4%	9 (3.9%)	
GRADE				
1	58 (13.6%)	30(15.0%)	28 (12.3%)	0.035
2	178 (41.6%)	70 (35.0%)	108 (47.4%)	
3	192 (44.9%)	100 (50.0%)	92 (40.4%)	
T				
0	25 (2.8%)	14 (6.9%)	11 (4.8%)	0.276
1	147 (34.0%)	75 (36.9%)	72 (31.4%)	
2	248 (57.4%)	107 (52.7%)	141 (61.6%)	
3	12 (2.8%)	7 (3.4%)	5 (2.2%)	
N				
0	291 (68.0%)	136 (68.0%)	155 (68.0%)	0.995
1	104 (24.3%)	48 (24.0%)	56 (24.3%)	
2	23 (5.4%)	11 (5.5%)	12 (5.4%)	
3	10 (2.3%)	5 (2.5%)	5 (2.3%)	
ER				
positive	351 (91.4%)	164 (81.2%)	187 (81.7%)	0.499
negative	80 (18.6%)	38 (18.8%)	42 (18.8%)	
PR				
positive	318 (74.3%)	150 (74.3%)	168 (74.3%)	0.536
negative	110 (25.7%)	52 (25.7%)	58 (25.7%)	
c-erb B2				
positive	66 (16.5%)	36 (19.6%)	30 (13.9%)	0.139
negative	334 (83.5%)	148 (80.4%)	186 (86.1%)	
Intraductal Component				
yes	203 (54.4%)	87 (54.0%)	116 (54.7%)	0.472
no	170 (45.6%)	74 (46.0%)	96 (45.3%)	
Ki 67	27.5 (10-40)	30 (10-48)	25 (10-40)	p=0.604***
Adjuvant CT				
yes	337 (78.0%)	154 (75.9%)	183 (79.9%)	0.185
no	95 (22.0%)	49 (24.1%)	46 (20.1%)	
Adjuvant RT				
yes	426 (98.8%)	198 (97.5%)	229 (100.0%)	0.022
no	5 (1.2%)	5 (2.5%)	0	
Adjuvant HT				
yes	359 (83.1%)	91 (83.4%)	191 (83.4%)	0.479
no	73 (16.9%)	35 (17.2%)	38 (16.6%)	

***Mann-Whitney U test. BCS: conservative breast-conserving surgery, OPS: oncoplastic breast-conserving surgery, DCIS: ductal carcinoma in-situ, IDC: invasive ductal carcinoma, ILC: invasive lobular carcinoma, T: tumor size, N: lymph node status, CT: chemotherapy, RT: radiation therapy, HT: hormonotherapy.

(94 patients), batwing (4 patients), and round block (12 patients) techniques.

The two groups had no statistical differences for additional imaging needs in general (p=0.138). On the other hand, additional mammography use was particularly higher in the OPS group (p=0.003) (Table III). This difference was more significant in the early post-operative period. Also, another increase after the 4th year was similar to the first group (Figure 1).

The two groups had no statistical difference in MRI need. On the other hand, we determined that 49.4% of the MRIs were in the post-operative first year. Furthermore, 76.5% were conducted within two years following surgery (Figure 2).

One hundred ninety-seven patients had an additional radiological examination, including 85 (43.1%) in the BCS Group and 112 (56.9%) in the OPS Group. Biopsy needs for patients with additional imaging were 24.7% and 19.6% per

Table III. Comparison of additional imaging.

	Total n (%)	Group 1 BCS n (%)	Group 2 OPS n (%)	*p*-value
Additional Mammogram				
yes	37 (8.6%)	9 (4.4%)	28 (12.2%)	0.003*
no	395 (91.4%)	194 (95.6%)	201 (87.8%)	
Additional Ultrasound				
yes	47 (10.9%)	20 (9.9%)	27 (11.8%)	0.313
no	385 (89.1%)	183 (90.1%)	202 (88.2%)	
MRI				
yes	166 (38.4%)	75 (36.9%)	91 (39.7%)	0.310
no	206 (61.6%)	128 (63.1%)	138 (60.3%)	
Additional imaging (MG+US+MRI)				
yes	197 (45.6%)	85 (41.9%)	112 (48.9%)	0.085
no	235 (54.4%)	118 (58.1%)	117 (51.1%)	
Findings with MRI				
BI-RADS 1-2	73 (45.9%)	36 (48.6%)	37 (43.5%)	0.133
BI-RADS 3	80 (50.3%)	38 (51.4%)	42 (49.4%)	
BI-RADS 4-5	6 (3.8%)	0	6 (7.1%)	

*: Additional mammography use was found to be higher in the OPS group. BCS: conservative breast-conserving surgery, OPS: oncoplastic breast-conserving surgery, MRI: magnetic resonance imaging, MG: mammography, US: ultrasonography.

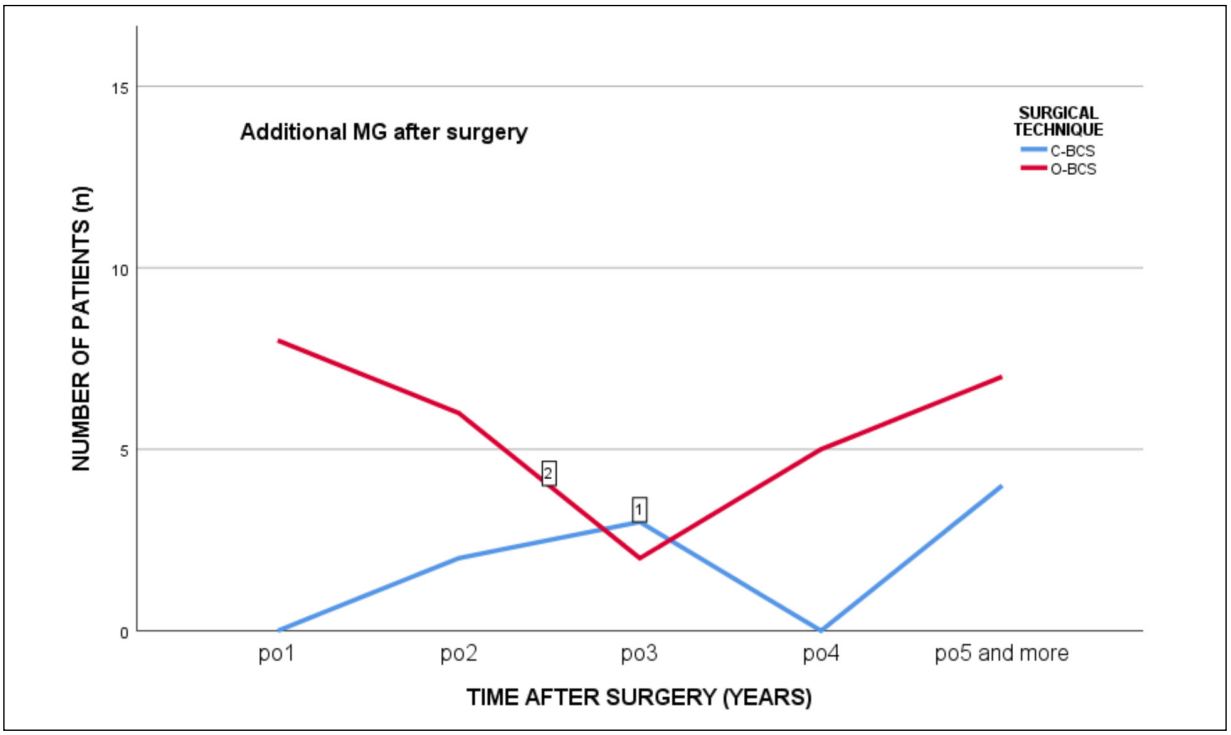

Figure 1. Additional mammography use in years. BCS: conservative breast-conserving surgery, OPS: oncoplastic breast-conserving surgery, MG: mammography, po: post-operative time in years.

group, respectively (p=0.486). Also, there were no statistical differences in biopsy needs between the two groups, particularly in patients who had additional MG, US, or MRI performed.

Sixty-two patients (14.3%) had biopsies with suspicious radiological findings. Of these patients, 32 (51.6%) were in BCS Group, and 30 (48.4%) were in the OPS Group (p=0.492). Only eight (12.8%) of these patients had malignant results. Two patients had post-radiational angiosarcoma, and both of these were in the BCS Group. Local recurrences were presented in six patients, one

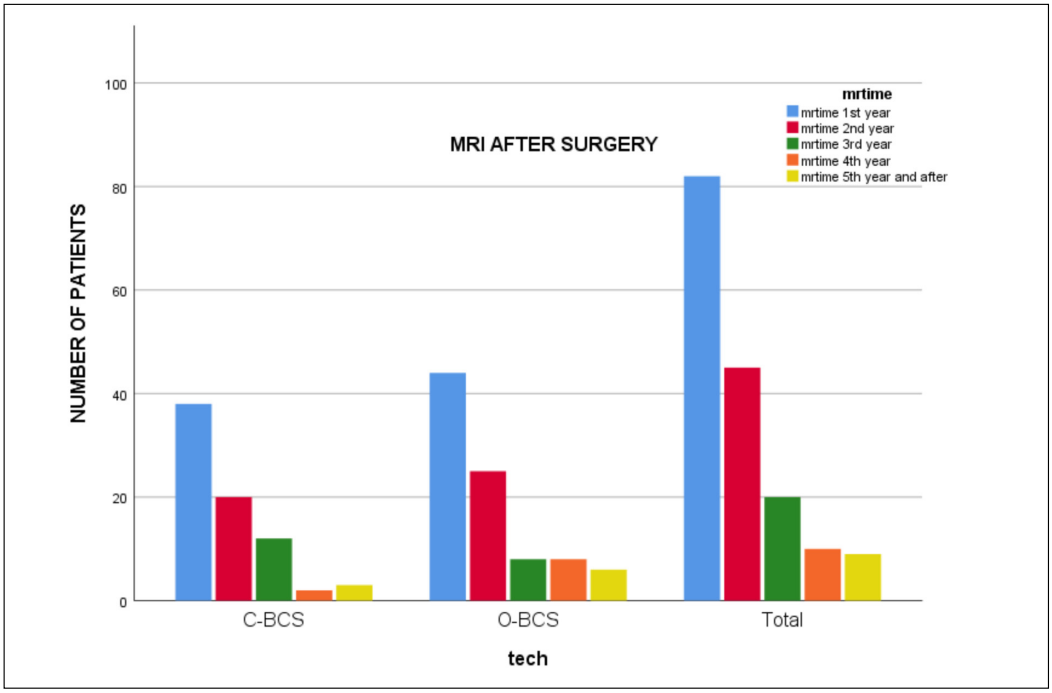

Figure 2. Magnetic Resonance Imaging (MRI) after surgery in years.

(1.6%) in the BCS Group and five (8.1%) in the OPS Group (p=0.084) (see Table IV). Out of all the biopsies, 88.7% were unnecessary. However, both groups had comparable numbers, with 29 in the BCS and 25 in the OPS group.

Discussion

OPS is a safe surgical technique for breast cancer patients and has become increasingly preferred worldwide. At the Milan International Oncoplastic Breast Surgery Meeting, it was recommended to use oncoplastic surgery instead of standard breast conservation surgery for breast cancer treatment[7]. OPS techniques can lower mastectomy rates and speed up hospital discharge. They aid in resource allocation during COVID-19[8].

On the other hand, there are still concerns about the post-surgical process, with questions raised regarding whether OPS increases radiological examinations or causes unnecessary biopsies with increased follow-ups[9].

So far, only a few studies[6,10] have compared additional imaging and biopsy needs for OPS and BCS patients. Crown et al[10] found no differences between groups for additional imaging and biopsy needs. However, the follow-up intervals for groups in that study were different and shorter. Dolan et al[6] concluded that OPS required more ultrasound scans and consequent biopsies from an analysis of 128 *vs.* 83 patients. Another study[11] exploring mammographic stabilization time had a small sample of only 34 patients.

In our study, we evaluated 432 patients with 66 months median follow-up time to see if there was a difference in long-term follow-ups. Patients were analyzed in two groups, similar in demographic characteristics and follow-up times (64 *vs.* 70 months). The sample between 2013 and 2017 has been selected to compare the similar number of patients in both groups and obtain a longer follow-up time.

As mentioned in the results section, we found increased mammography use in the OPS group. The difference was significant in the early post-operative period. Half of the patients with additional MG were in the post-operative first two years. After five years, both groups have a similar peak of additional mammography needs (Figure 1).

Although the two groups had no statistical difference in MRI need, we determined that 49.4% of the MRIs were in the post-operative first year. Furthermore, 76.5% occurred within two years after surgery (Figure 2). These findings may be related to the time required for radiological stabilization.

MRI is not recommended for routine breast cancer follow-up in asymptomatic patients, only

Table IV. Biopsy needs and pathological findings.

	Total n (%)	Group 1 BCS n (%)	Group 2 OPS n (%)	*p*-value
Post-operative biopsy				
yes	62 (14.4%)	32 (15.8%)	30 (13.1%)	0.492
no	370(85.6%)	171 (84.2%)	199 (86.9%)	
Local recurrence				
yes	6 (1.4%)	1 (0.5%)	5 (2.2%)	0.138
no	426 (98.6%)	202 (99.5%)	224 (97.8%)	
Pathological result				
Benign	54 (87.1%)	29 (46.8%)	25 (40.3%)	0.467
Malign	8 (12.9%)	3 (4.8%)	5 (8.1%)	
Pathological findings in benign results				
Normal breast tissue	11 (20.4%)	5 (17.2%)	6 (24.0%)	
Fat necrosis	17 (31.5%)	7 (24.1%)	10 (40.0%)	
Granulation tissue	11 (20.4%)	6 (20.7%)	5 (20.0%)	
Other benign findings	15 (27.7%)	11 (37.9%)	4 (16.0%)	
Pathological findings in malign results				
Local recurrence	6 (9.7%)	1 (1.6%)	5 (8.1%)	0.084
Postradiational angiosarcoma	2 (3.2%)	2 (3.2%)	0	
Biopsy type				
FNA	14 (22.6%)	7 (11.3%)	7 (11.3%)	0.664
Tru-cut	22 (35.5%)	13 (21.0%)	9 (14.5%)	
Wire-guided excisional	26 (41.9%)	12 (19.4%)	14 (22.6%)	

BCS: conservative breast-conserving surgery, OPS: oncoplastic breast-conserving surgery, FNA: fine needle aspiration.

for clinical or radiologic suspicious findings[12]. Despite current guidelines, MRI should be performed in suspicious cases and patients at high risk of tumor relapse[13].

Most local recurrences for breast cancer occur in the first two to three years after surgery[14]. High BMI of patients undergoing oncoplastic surgery is often considered a risk factor during follow-up[15]. Age is also a well-known risk factor for regional recurrence[16].

Sixty-two (14.3%) patients in our sample had a biopsy because of a suspicious imaging result. Forty-three of them had additional imaging before the biopsy decision. There was no significant difference between the two groups in terms of biopsy needs. Seven patients (11.3%) had malignant pathological results. Thus, 88.7% of the biopsies conducted on those patients were deemed unnecessary, but both groups had similar numbers, with 29 and 25, respectively.

The need for repeated additional imaging was less in patients with long-term follow-up. As experience in this field increases, the need for additional imaging in patients undergoing OPS should decrease. Radiological evaluation may be more difficult in young patients after OPS due to tissue density[17]. Re-evaluating patients with breast concerns by radiologists specializing in breast cancer at tertiary centers could lead to a decrease in unnecessary percutaneous biopsies[18].

We analyzed our data for the initial times of our experience in OPS. Therefore, we could analyze longer follow-up times for the parameters. However, this was also a new subject for the breast radiology team to perform and determine imaging of OPS patients. This may be a limitation for our study, which can be enlightened by observing if there is a change in the years to come as more experience is accumulated.

The necessity for repeated additional imaging decreased in patients with longer follow-ups. Additional imaging for patients undergoing OPS should diminish as expertise in this area develops. Our data analysis pertains to our initial experiences with OPS. As such, we could focus on longer follow-up durations.

Our study has other limitations, such as a retrospective single-center study and a relatively small sample of our patients. However, we limited our data to obtain a similar number of group patients and longer follow-up times.

Conclusions

Although there was no statistical difference in groups in additional imaging, we did find incre-

ased MG use in the OPS group in the subgroup analysis. Additional radiological examinations were performed more in the early years after surgery. These findings may be related to the time required for radiological stabilization for these patients.

In conclusion, the OPS techniques may increase post-operative mammography use. However, there is no statistical difference between the two groups for either additional imaging in total or in biopsy needs.

Ethics Approval

This study was approved by the University of Health Sciences Institutional Review Board, Dr. Ay Ankara Oncology Health Application and Research Center (Approval Code: 2021-05/1182). This study was conducted according to the ethical standards of the Declaration of Helsinki.

Informed Consent

Informed consent was waived due to the retrospective design of the study.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflict of Interest

The authors declare that they have no competing interest.

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Authors' Contributions

Gamze Kiziltan: Data curation, software, writing, investigation and editing. Cihangir Ozaslan: Conceptualization, methodology, validation and supervision. All authors revised the manuscript and approved the final version.

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