Bilateral Mammoplasty for Cancer: Surgical, Oncological and Patient-Reported Outcomes

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ABSTRACT

Introduction

Bilateral mammoplasty (BM) can optimise oncological safety and aesthetic outcomes in women with large or ptotic breasts whose tumour to breast volume ratio or tumour location pose a challenge to standard breast conserving therapy (BCT) and for whom mastectomy (with or without reconstruction) may be the only alternative.

Methods

We undertook a comprehensive analysis of surgical outcomes (complications according to the Clavien Dindo classification), acute radiation morbidity (Radiation Therapy Oncology Group classification), oncological outcomes, and patient satisfaction (BREAST-Q questionnaire) in women who underwent BM for breast cancer (BC) from June 2009-November 2014.

Results

168 women were included. Median age was 55 years (range: 33-84) and median tumour size at imaging 35mm (range:0-170). Median specimen weight was 242g (range: 39-1824). The wise pattern technique was used in 87.5% of procedures. At least one complication occurred in 68 (40.5%) women most of which were Clavien Dindo grade 1. Grade 3 complications were infrequent (8.9 %) but occurred mainly on the therapeutic mammoplasty (TM) side ($p<0.05$). Complications were associated with higher BMI, specimen weight and longer time to radiotherapy ($p<0.05$).

Median follow-up was 37 months (range: 13-77). Local recurrence occurred in 3(1.8%), distant metastases in 5(3.0%), and 10(6.0%) women have died. Tumour size ≥4 cm was associated with a higher rate of distant recurrence and margin involvement ($p<0.05$). The median score for 'satisfaction with breasts' was 77 (range: 0-100).

Conclusions

This study provides concurrent data on surgical, oncological and patient-reported outcomes. It offers evidence that BM is an effective treatment for breast cancer in large- or ptotic-breasted women, particularly if mastectomy is the alternative.

INTRODUCTION

Oncoplastic breast surgery was established in the 1990s to facilitate tumour resection without compromising aesthetic appearance[1; 2; 3]. Therapeutic mammoplasty was first described by Clough et al. in 1990 in a study of patients undergoing breast reduction surgery to remove a lower pole cancer[4]. Therapeutic mammoplasty has become a widely available option and is applied predominantly to large-breasted women. The estimated prevalence of macromastia in women treated with breast-conserving therapy (BCT) (surgery and radiotherapy) is up to 40%[5; 6]. Criteria defining macromastia are not universally agreed, but published data suggest that the most accepted are cup size≥D or a bra size≥40 inches[5; 7]

A patient with large or ptotic breasts whose tumour to breast volume ratio and/or tumour location poses a challenge to standard BCT may benefit from therapeutic mammoplasty[8; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18]. Up to 30% of patients after BCT have poor cosmetic results due to surgery and irradiation, which may result in breast distortion and deformities that are challenging to correct[19; 20]. Aesthetic outcome after BCT is affected by breast size, and unfavourable results are more common in women with macromastia as they experience more asymmetry, retraction and late radiation changes than small-breasted women[7; 10; 11; 21]. Thus women with large breasts who are at increased risk of acute radiotherapy toxicity may also be candidates for therapeutic mammoplasty even with a favourable tumour to breast volume ratio.

The aim of this study was to analyse outcomes after BM from a single large centre concurrently reporting on surgical, oncological and aesthetic outcomes, notably including patient satisfaction.

PATIENTS AND METHODS

All patients who underwent BM for breast cancer from June 2009 to November 2014 were included in this retrospective review. At our institution, oncoplastic breast surgeons offer BM to suitable patients (cup size≥D or moderate to significant of ptosis), performing either immediate or delayed symmetrisation. The reduction technique was selected by the surgeon after discussion with the patient about her acceptance of scars, the breast size, the degree of ptosis and tumour size and location. Patients who had delayed symmetrisation were included, provided that both operations were performed during the study period. The operated

breasts were divided into therapeutic mammoplasties (TM) and contralateral symmetrising mammoplasties (SM).

Data was collected from a prospectively maintained database and electronic medical records and recorded in Microsoft Excel (Microsoft Corp, Redmond, Wash.). Preoperative data included patient demographics, smoking history and co-morbidities (obesity, diabetes) and tumour characteristics (largest preoperative size at imaging, location, pathological details) and any neoadjuvant treatment. Surgical technique for each breast and timing of contralateral symmetrisation, nipple-areola complex removal and either immediate or delayed nipple reconstruction were recorded. Postoperative histopathological details included tumour features, resection (index breast) and reduction (contralateral breast) specimen weights, and nodal involvement. Adjuvant endocrine therapy, chemotherapy and radiotherapy and time to commencing the first adjuvant treatment were also recorded.

Surgical and radiation outcomes

Surgical outcome measures included complications within 30 days of surgery, grouped according to the Clavien Dindo Classification[22] (Table 1). Patients were divided into two groups according to whether postoperative complications occurred or not, and compared for preoperative, surgical and postoperative characteristics including length of hospital stay, readmission within 30 days, delay (>6 weeks post-operatively) in starting adjuvant treatment and requirement for revision surgery. Radiation skin reactions were recorded according to the Radiation Therapy Oncology Group (RTOG) Scoring System for acute radiation morbidity in grades I to IV.[23; 24]

Oncological outcomes

Oncological outcomes comprised rates of radial margin involvement, margin re-excision, additional radiotherapy boost, conversion to mastectomy, loco-regional recurrence, distant recurrence and death. For all of the study period a margin was considered negative if greater than 1mm from invasive cancer and 2mm from DCIS.

Patient Satisfaction

Patient satisfaction was evaluated using a validated questionnaire (BREAST-Q Breast Conserving Therapy Module)[25]. Patients who moved abroad, developed distant disease or

went on to have mastectomy were excluded. A score for each of the nine domains within the questionnaire was derived and then transformed to a scale of 0-100 according to the BREAST-Q protocol. Higher scores equate to more favourable outcomes. Patients were divided into less and more satisfied according to whether their score for 'satisfaction with the breasts' domain fell above or below the median. Differences in patient and tumour characteristics were evaluated between these two groups. We compared satisfaction with breast symmetry in patients who had immediate versus delayed symmetrisation, and satisfaction between patients who had no nipple reconstruction and the rest of the cohort.

Statistical Analysis

The mean and standard deviation were calculated for all parametrically-distributed variables, while the median and the range of values were calculated for non-parametric variables. Fisher's exact test was applied for categorical data, Student's t test for continuous normally distributed data and Mann-Whitney test for non-parametric data.

RESULTS

During the period reviewed, 168 patients underwent BM for cancer. Of 336 procedures, 177 were therapeutic (9 women had bilateral BC) and 159 symmetrising (9 of these had incidental cancer but for the purpose of analysing outcomes, they have been classified by intention to treat). 155 patients underwent synchronous bilateral surgery, while 13 underwent unilateral therapeutic mammoplasty followed by a delayed contralateral symmetrisation after a median of 14 months (range: 5-30). The median follow-up from index surgery was 37 months (range: 13-77).

The median age at primary surgery was 55 years (range: 33-84), and median body mass index (BMI) was 29.3 kg/m^2 (range: 19.2-49.2). Patient and tumour characteristics are summarized in Table 2. The wise pattern technique was used in 87.5% (294/336) of procedures. In 56.3% (189/336) of these the inferior pedicle was chosen as single pedicle, or as inferocentral when a bipedicle. The remaining breast reduction techniques included: 18 (5.3%) round block, 13 (3.9%) short scar periareolar inferior pedicle, 7 (2.1%) lateral, 2 (0.6%) omega, 2 (0.6%) vertical mammoplasty. The nipple-areola complex was removed in 49 breasts (14.6%), generally as a planned, oncological procedure, with 6 (1.8%) breasts having immediate and 12 (3.6%) delayed nipple reconstruction with C-V flaps, while the remaining patients declined further surgery. The median therapeutic resection specimen weight was 242g (range:

39-1824), while the median symmetrising reduction specimen weight was 260g (range: 34-1700). Reduction specimen pathology identified incidental malignancy in the symmetrising specimen in 9 (5.4%) patients, all being DCIS ranging from 2 to 65 mm.

Of the 168 women, 4 converted to mastectomy, 6 had no adjuvant therapy and in 20 adjuvant data were not available. Of the remaining 138 (82.1%), 84 underwent radiotherapy, 50 chemotherapy and 4 endocrine therapy as first adjuvant treatment.

The median time from surgery to first adjuvant treatment was 51.5 days (range: 21-153), 57 days (range: 30-153) for radiotherapy and 39.5 days (range: 21-81) for chemotherapy (Figs. 1 and 2).

Surgical and Radiation Outcomes

At least one complication was recorded in 68 (40.5%) women and 87 (25.9%) breasts (Table 3). Multiple complications of different grades were reported as separate events so for simplification we stratified women and breasts according to the highest grade complication recorded.

Grade 1 complications were the most frequent (23.8% of patients and 16.3% of breasts), while grade 2 or 3 complications affected only 8.3% of patients. BMI and reduction specimen weight were higher in patients with complications (*p* values: 0.0001 and 0.0028 respectively) regardless of whether the indication for surgery was therapeutic or symmetrising. The only significant difference between TM and SM groups in terms of complication rate was the occurrence of grade 3 complications, which were more frequent in the TM group ($p < 0.05$). Furthermore TM complications resulted in a significantly increased time to radiotherapy (RT) with a median of 77 days (range: 33-153) compared with 55 days (range: 30-94) for no TM complications (*p* value: 0.03). Contralateral SM complications would not delay RT. Median time to chemotherapy showed no significant difference (*p* value: 0.285) between those who experienced complications (regardless of which side) and those who did not.

The median hospital stay was 1 night (range: 0-6). Unplanned readmission (<30 days after primary surgery) was required in 6 (3.6%) patients because of complications (3 haematomas, 1 nipple necrosis, 1 infection requiring surgical revision (all Clavien 3b) and one infection requiring intravenous antibiotics (Clavien 2).

Acute skin reactions after radiation were reported in 39 (23.2%) patients. Acute radiation morbidity was classified in four grades according to RTOG scoring system, 24 (14.3%) patients experiencing grade 1 morbidity (follicular, faint or dull erythema, dry desquamation), 11 (6.5%) patients grade 2 (tender or bright erythema, patchy moist desquamation, moderate erythema), 4 (2.4%) patients grade 3 (confluent moist desquamation, other than skin folds, pitting oedema). No grade 4 skin reactions (ulceration, haemorrhage, necrosis) were seen.

Oncological outcomes

Radial resection margins were involved in 20 (11.3%) of the 177 breasts, of which four (2.3%) converted to mastectomy and eight (4.5%) were re-excised. Six (involved by DCIS alone) were treated by tumour bed RT boost and two patients had metastases at diagnosis. A further 4 patients underwent mastectomy at a later date, 3 for local recurrence (1.8%) and one after a BRCA mutation was discovered. At a median follow-up of 37 months, three (1.8%) have had local recurrence, five (3.1%) were alive with distant metastases and ten (6.1%) women had died of BC.

Patients with a tumour size of > 4 cm at diagnosis had a significantly higher risk of distant recurrence and margin involvement than those with smaller tumours (<4cm) (p value <0.05).

Patient Satisfaction

The 137 eligible patients were sent the BREAST-Q questionnaire by post and 72 (52.6%) replied. Results are shown in Table 4. The median score for patient 'satisfaction with breasts' was 77 (range: 0-100), therefore the 34 with a score <77 were considered less satisfied, while the 38 whose score was ≥77, were considered more satisfied. Between-group comparisons showed no significant differences in clinico-pathological data, surgical or oncological outcome measures. Patients who had no nipple reconstruction showed no significant difference in satisfaction with the breasts compared to the rest of the cohort (*p* value: 0.16). As the development of late asymmetry is often the rationale for avoiding immediate symmetrisation, we specifically analysed the question "How satisfied are you with how much your breasts look the same?". There was no significant difference between the immediate and delayed symmetrisation groups (*p* value>0.05).

DISCUSSION

Therapeutic mammoplasty is a common keyword in the recent literature on surgical treatment of breast cancer, yet the definition is controversial. Some authors count every breast-conserving procedure involving parenchymal mobilisation as a therapeutic mammoplasty, while for others therapeutic mammoplasty is limited to the application of breast reduction techniques to breast oncological surgery. According to the former definition, Fitoussi et al. published the largest case series in 2010, combining bilateral or unilateral application of plastic surgical techniques to oncological excisions [26]. According to Clough's definition of oncoplastic surgery, reduction mammoplasty techniques which already exist in plastic surgery and combine breast reduction and tumour resection are known as level II oncoplastic resections; the volume excised means the majority of these require contralateral symmetrisation[27].

We followed Clough's definition, applying breast reduction techniques to large or ptotic breast and ours is one of the largest reported series of immediate BM for cancer. While the resection volumes are not large by comparison with patients undergoing mammoplasty for symptoms of macromastia, the median specimen weight of 242g (range: 39-1824g) is substantially larger than the median resection weight of (32.5g (range: 9-346g) in a contemporary series of standard breast conservation in our institution. Grubnik et al. included any oncoplastic technique involving parenchymal and nipple-areola complex displacement. Their *mean* resection weight was smaller (237g compared with our *mean* of 321.1g)[9]. Egro et al. have published data on 160 patients who underwent reduction mammoplasty, 96% being bilateral. They showed that the 117 immediate reduction mammoplasty patients had lower morbidity, fewer procedures and good aesthetic outcomes when compared to delayed procedures performed after radiotherapy[28].

In addition to the issues of definition, detailed data evaluating these procedures are still limited. McIntosh et al. reviewed all studies of "therapeutic mammoplasty" in 2012, finding no consistency in reporting indications or outcome[29]. Later series show the same limitations [6; 9; 28; 30; 31; 32; 33; 34; 35]. Just as Potter et al.[36] outlined a core dataset for reporting on breast reconstruction, so a similar structure should be followed for oncoplastic breast conservation, namely concurrent reporting of oncological parameters, and surgical and patient-reported outcome measures. We reported on all of these outcome measures and, at the time of writing, we are the only group to have done so.

Furthermore, to standardise reporting we used validated and well-known systems of classification. The Clavien Dindo Classification of surgical complications is therapy-oriented and has been developed to allow comparison of complications arising from different surgical procedures[22]. Similarly, the RTOG grading is recognised as the most clinically useful method of documenting skin reaction; it is widely used in the literature on acute radiotherapy complications[23; 37]. Finally, the Breast Conserving Therapy (BCT) module of the BREAST-Q questionnaire is the latest module in a suite of validated tools for patient-reported outcomes and is here utilised for the first time after therapeutic mammoplasty. Previous studies of therapeutic mammoplasty reported results from non-validated tools, or used the Breast Reduction Module of the BREAST-Q which was created for cosmetic surgery[28; 29; 38]. We chose the BCT Module to assess patient satisfaction with the breast and the adverse effects of radiation which are breast cancer-specific domains of this module[25; 39].

Surgical outcomes

Despite BM being more complex surgery than standard BCS, we reported a short length of hospital stay (median: 1 night) and a low rate of readmission within 30 days (3.6%). We found a complication rate of 16.3% of breasts, which is comparable to previous series of oncoplastic breast surgery[8; 40]. Benchmarking against other reports using the Clavien Dindo system, our complication rates are within the reported range reported by Panhofer et al. for example. Our BM cohort resembles their mastectomy group (24.2% grade 1, 11.7% grade 2 and 3.9 % grade complications) more closely than their BCT group (4.8% grade 1, 7.3% grade 2, 4.8% grade 3 and 0.3% grade 4), which included both wide local excisions and oncoplastic procedures[22].

The only significant difference between therapeutic and symmetrising procedures in our series was in the incidence of grade 3 complications, but the number of cases was too small to draw meaningful conclusions. Grade 1 complications were the commonest regardless of whether the surgical intent was therapeutic or symmetrizing. Even though these are minor complications from the surgical perspective, their duration affects patient quality of life and may result in a delay to adjuvant treatment to a greater extent than a grade 3 complication, which can be solved by a brief intervention (e.g. delayed wound healing versus postoperative haematoma).

Several studies have reported no significant delay in adjuvant treatment after oncoplastic procedures and our data confirm this for adjuvant chemotherapy, showing no difference in

the time from surgery to chemotherapy between patients with and without complications (*p* value:0.285) [35; 41; 42]. Conversely, the time from surgery to radiotherapy was statistically significantly longer when complications occurred, perhaps due to the fact that complete wound healing is thought to be mandatory before radiation (Figs.1-2). Current UK National Institute for Health and Clinical Excellence guidelines[43] state that adjuvant therapy should be commenced as soon as clinically possible within 31 days of completion of surgery, yet the optimum time interval between surgery and radiation has not been established. Given that delayed wound healing was the most common complication, new solutions such as pre-emptive negative pressure wound therapy on the incised wound could be considered [44].

Acute radiation morbidity is an important cause of distress, especially for large-breasted patients. In this series of BM, the RTOG grades were comparable to data reported for wide local excision only, perhaps because of better radiation dose distribution[24; 45].

Oncological outcomes

There is on-going debate about whether oncological outcome after therapeutic mammoplasty should be compared with patients undergoing mastectomy or standard BCT. Mansell et al. recently argued in favour of comparison with mastectomy[46]. Certainly, our patients with a median tumour size of 35mm, 74.6% of tumours being pT2-T3 and the macrometastasis node positive rate of 32.5% are more in line with the mastectomy cohort presented in that study (50.9% pT2-T3 tumours, 46.8% positive nodes). The 3.1% distant metastasis and 6.1% breast cancer related mortality rates, are also in line with previous studies with similar or longer follow-up (12-14% and 7-10% respectively)[29] notwithstanding 47.6% of our patients had tumours larger than 4 cm which was associated with higher rates of distant recurrence and margin involvement in our series. However if the tumour characteristics are matched then, as described by De Lorenzi et al.[47], comparison with standard BCS is appropriate. They included volume displacement and replacement techniques (fasciocutaneous flaps, implant) and did not give a mean specimen weight, so direct comparison with our cohort is not possible.

The local recurrence rate in our series was 1.8% at a median follow up of 37 months which is within the range reported in many series of breast-conserving treatment for more favourable disease[48]. Like Bamford et al[35], but unlike most previous series[9; 49; 50; 51; 52; 53], we also

included multifocal/multicentric and larger tumours which does not seem to have adversely affected local control. While we agree with Mansell et al. that the cohort is higher risk than most standard BCT series, if the local recurrence rates are so low, then equivalence with standard BCT, in terms of local control, remains a valid goal (46).

Patient-reported outcomes

The key PROMs in this study were satisfaction with breasts and adverse effects of radiotherapy. The median value of 77 (range: 0-100) for 'satisfaction with the breast' is comparable both to previous studies and to a cohort of women who underwent standard BCT at our institution[54]. The median score of 89 for 'adverse effect of radiation' (range: 73-100) is slightly better than our BCT population, suggesting that the decrease in breast size has a positive effect. In most series of BREAST-Q, satisfaction with information and personnel are very high, and this is mirrored in our results. Results for physical, psychological and sexual wellbeing are also in line with other series. When compared with the UK National Mastectomy and Reconstruction Audit in 2011, this cohort of therapeutic mammoplasty patients has a higher physical wellbeing score (75.9) than those who underwent mastectomy and immediate reconstruction with implant and/or pedicled flap (73-75), and a similar score to those who underwent autologous free flap reconstruction (76)[55]. Sexual wellbeing had the lowest response rate and a median score of only 54.5. Again this is seen in other studies and highlights a side effect of the disease and therapy which is often underestimated and under-reported by patients.

This was a non-randomised single centre study with moderate follow-up. We did not directly assess cosmetic outcome, as we focused on the patient's perception of the aesthetic results which is often different from the clinician's view. Our evaluation of patient satisfaction is limited by a response rate of 52% to the BREAST-Q questionnaire. This may be because, at a median follow up of 37 months, women's lives have become busy with non-healthcare activities. Sending a paper questionnaire and requiring return by post may have limited uptake and introduced a source of bias. We advocate routine collection of PROMs data at strategic points along the patient's treatment pathway.

The future for BM

If the indications for BM can be more clearly defined and outcomes evaluated prospectively against a truly comparable cohort of women it may be possible to demonstrate that BM offers

significant additional benefit over the alternatives (standard breast-conservation for some, mastectomy and reconstruction for others). It is difficult to recruit women into randomised controlled trials in surgery as these often involve subjective and patient-driven choices. [56] However prospective collaborative national audits are providing useful data in the breast surgery setting [57; 58] and a study of therapeutic mammoplasty with a similar design is in the planning phase in the UK[58].

Conclusion

This study provides concurrent data on surgical, oncological and patient-reported outcomes after BM. BM achieved surgical and oncological outcomes within published ranges with high levels of patient satisfaction. Despite some limitations, this study offers further evidence that BM is a safe and effective treatment for breast cancer and may allow some women the opportunity to avoid mastectomy.

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This work has been presented orally at the Rome Breast Conference (no published abstract) and as a poster at the UK Association of Breast Surgery Annual Conference, published in abstract form:

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Table 1 Clavien Dindo Classification adapted for breast cancer[26]

GRADE	**Definition**
Grade 1	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical or radiological interventions. Allowed drugs: antiemetics, antipyretics, analgesics, diuretics, electrolytes and physiotherapy. e.g. seroma/haematoma not requiring drainage, minor skin necrosis, delayed wound healing
Grade 2	Complications requiring pharmacological treatment with drugs other than such allowed for grade 1. (e.g. wound infection).
Grade 3	Complications requiring intervention 3a: not under general anaesthesia e.g. seroma/haematoma which were drained under US guidance, skin necrosis undergoing debridement 3b: under general anaesthesia e.g. major skin necrosis, wound infection requiring debridement, bleeding
Grade 4	Life-threatening complication
Grade 5	Death

Table 2 Patient and Tumour Characteristics

Population	Number (%) or Median(range)
Total number of patients	168
Mean Age ± SD (years)	55(33-84)
Overweight (BMI 25-30kg/m^2)	55(32.7)
Obesity (BMI>30kg/m^2)	79(47.0)
Diabetes	5(3.0)
Smoking history (current /ex smokers)	74(44.0)
Ethnicity	
White	125(74.4)
Black	13(7.7)
Asian	10(6.0)
Other	20(11.9)
Tumour Characteristics	
Total number of affected breasts	177
Median preoperative tumour size (range), mm	35(0-170)
Median pathological tumour size (range), mm	35(0-136)
Tumour Location	
Upper outer quadrant	87(49.2)
Central	24(13.6)
Lower outer quadrant	23(13.0)
Upper inner quadrant	19(10.7)
Lower inner quadrant	17(9.6)
Multicentric	7 (4.0)
Multifocal	23(13)

Tumour pathology	
DCIS	14(7.9)
IDC+DCIS	98(55.4)
IDC	31(17.5)
ILC	25(14.1)
Mixed IDC/ILC features	4(2.3)
Paget's disease	2(1.1)
Other (metaplastic, mucinous cancer)	3(1.7)
Grade 1	16(29.6)
Grade 2	67(43.5)
Grade 3	71(46.1)
ER+	139(78.5)
PR+	118(66.7)
Her2+	24(13.6)
ALND	59(33.3)
SLNB	113(63.9)
No axillary procedures	5(2.8)
pN0	108(62.8)
pN1mic	8(4.7)
pN1 (1-4)	40(23.2)
pN2(4-9)	10(5.8)
pN3(>9)	6(3.5)
Other treatment	
Neoadjuvant chemotherapy	57 (33.9)
Adjuvant chemotherapy	56(33.3)
Endocrine therapy	123(73.2)
Radiotherapy	153(91.1)

Table 3 Complication Rates

Complications	**TM (%)**	**SM (%)**	***p* value**
Total breasts	177	159	
Clavien Dindo Grade 1	36(20.3)	39(24.5)	0.362
Clavien Dindo Grade 2	15 (8.5)	7(4.4)	0.185
Clavien Dindo Grade 3	12(6.8)	3(1.9)	0.035
of which 3a	4(2.3)	0(0)	0.124
of which 3b	8(4.5)	3(1.9)	0.226
Total complications	63	49	0.417

Table 4 Patient Reported Outcomes

BREAST-Q subscale	**Median(IQR)**	**Mean**	**No answer**
Satisfaction with breasts	77 (57-93.25)	73.5	0
Adverse Effects of Radiation	89 (73-100)	84.2	1
Psychological Wellbeing	76 (63-100)	75.3	0
Sexual Wellbeing	52 (40-64)	53.1	17
Physical Wellbeing	75 (64-92)	75.9	1
Satisfaction with Information	84 (75-100)	82.5	2
Satisfaction with Surgeon	100 (100-100)	95.9	2
Satisfaction with Team	100 (100-100)	93.3	1
Satisfaction with Office Staff	100 (93-100)	93.2	0

Fig 1. Frequency distribution of time in weeks from surgery to radiotherapy

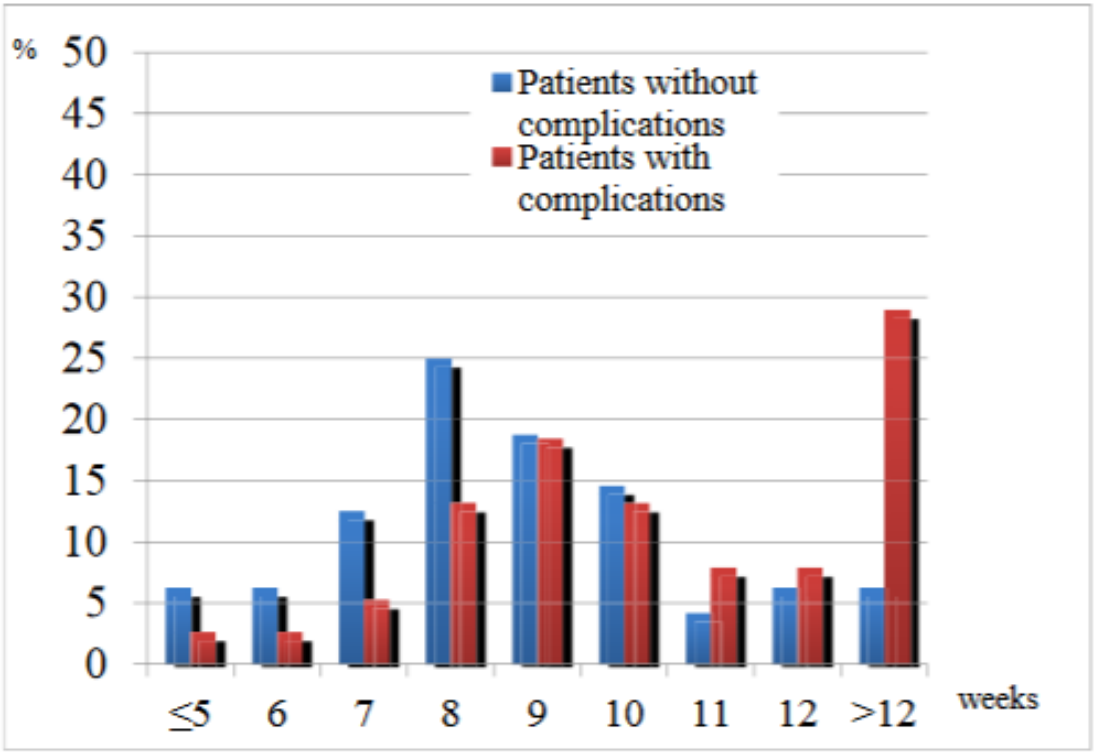
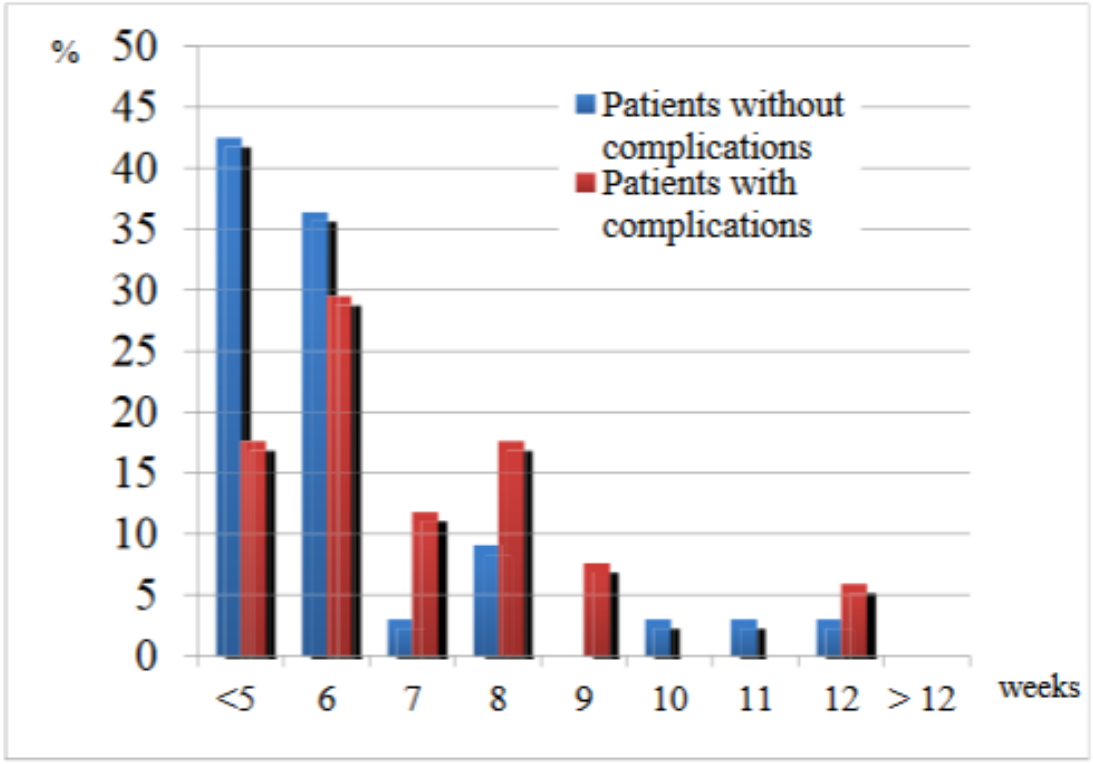


Fig 2. Frequency distribution of time in weeks from surgery to chemotherapy



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