



Re-Operation and Mastectomy Rates after Breast Conservative Surgery for Positive or Close Margins: A Review

Gilles Houvenaeghel^{1*}, Eric Lambaudie¹, Marie Bannier², Sandrine Rua Ribeiro², Julien Barrou², Mellie Heinemann¹, Max Buttarelli² and Monique Cohen²

¹Department of Surgical Oncology, Paoli Calmettes Institute and CRCM, CNRS, INSERM, Aix Marseille University, France

²Department of Surgical Oncology, Paoli Calmettes Institute, France

Abstract

Introduction: For positive or close margins after initial Breast Conservative Surgery (BCS) for Breast Cancer (BC), it is usually proposed re-operation with a second conservative surgery or mastectomy. We analyzed literature studies to determine re-operation rate and type of re-operation, differences according to treatment periods, histologic tumor type and results after initial BCS with oncoplasty.

Methods: We included 15 studies with highest numbers of patients treated from 2002 to 2016 and our institutional data from our institutional data base including patients treated from year 1995 to 2016. Re-operation rates and type of re-operation were determined for all studies, then according to successive treatment periods and different histologic tumor types. We specifically analyzed positive margins rates and positive or close margins rates for BCS with oncoplasty.

Results: Re-operation rate was 27.49% (CI 95% 27.4 to 27.6, range: 10.2% to 34%) among 402357 patients with BCS for DCIS or invasive BC with a decrease of re-operation rates among successive periods from 28.96% to 30.66% and 21.34%. Re-operation rates were higher for DCIS (33.1%) and lobular BC (40.6%). Mastectomy rate among patients with re-operation was 40.77% (CI 40.5 to 41.1, range: 10.7 to 62.1) and a third intervention for mastectomy was required for 13.5% of patients. We observed a decrease of mastectomy rates among successive periods from 59.62% to 48.8% and 36.81% with higher rate for lobular BC (70.5%). Positive margins rate after BCS with oncoplasty was 2.04% and close or positive margins were reported in 11.8%. Mastectomy rates for re-operation after BCS with oncoplasty were high (more than 60%).

Conclusion: Re-operation rate decrease progressively across successive and mastectomy rate also decrease progressively. Mastectomy rate is high for lobular invasive carcinoma and after initial resection with oncoplasty and patient's information for a risk of a third operation with mastectomy should be done in case of re-operation.

Keywords: Mastectomy; Re-operation; Breast cancer; Margins

Introduction

For positive or close margins after initial Breast Conservative Surgery (BCS) for Breast Cancer (BC), it is usually proposed re-operation with a second conservative surgery or mastectomy. Guidelines for re-operation have evolved during previous years: for invasive BC, margins ≥ 5 mm, then 2 mm and then "no ink on tumor" were required and for Ductal Carcinoma In-Situ (DCIS), margins ≥ 2 mm are usually required but without clear consensus.

Re-operation rates for BCS are extremely variable across the literature. This is mainly due to no clear consensus regarding the definition of a "negative margin", different preoperative and intraoperative tumor localizing methods, differences in intraoperative imaging techniques, specimen inking by surgeon or pathologist, the use of shave margins, tumor vs. lumpectomy size, surgeon volume of breast surgery per year, surgeon threshold to offer re-excision vs. mastectomy, patient's choice informed of third re-operation risk and no post-mastectomy radiotherapy for patients without axillary lymph node macro-metastases [1], surgical possibility with oncoplasty for re-excision [2-4].

OPEN ACCESS

*Correspondence:

Gilles Houvenaeghel, Department of Surgical Oncology, Paoli Calmettes Institute and CRCM, CNRS, INSERM, Aix Marseille University, 232 Bd de Sainte Marguerite, 13009 Marseille, France, Tel: 04.91.22.35.32/04.91.22.33.66; Fax: 04.91.22.36.13; E-mail: houvenaeghelg@ipc.unicancer.fr

Received Date: 04 Sep 2018

Accepted Date: 08 Oct 2018

Published Date: 10 Oct 2018

Citation:

Houvenaeghel G, Lambaudie E, Bannier M, Ribeiro SR, Barrou J, Heinemann M, et al. Re-Operation and Mastectomy Rates after Breast Conservative Surgery for Positive or Close Margins: A Review. *Clin Surg*. 2018; 3: 2149.

Copyright © 2018 Gilles Houvenaeghel. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Table 1: Re-operation rate.

Authors	Total BCS	Re-operation	
		Nb	%
van Leeuwen	34458	10018	29.1
Vos	32119	6241	19.4
Fisher	5659	1087	19.2
Jeevan	55297	11032	20
Wilke	241597	74517	30.8
Laghans	4118	725	17.6
Landercasper	6725	1451	21.6
Romics	656	67	10.2
Morrow 2009	1100	374	34
Morrow 2017	2509	543	22
Phipott	562	110	19.6
Findlay-Shirras	2494	556	22.3
Hughes	581	146	25.13
HeelanGladden	863	99	11.5
Shuk-Kay Tang	2858	492	17.2
Our datas	10761	3168	29.4
TOTAL	402357	110626	27.49
CI95			27.4-27.6

Table 2: Re-operation rates according to three periods.

Authors	Total BCS	Re-operation	
		Nb	%
Fisher 2002-2005	2586	503	19.45
2006-2009	3073	584	19
van Leeuwen			
2002-2005	9868	2974	30.14
2006-2009	11662	3445	29.54
2010-2013	12928	3599	27.84
Our data 1995-2004	3407	1117	32.78
2005-2010	2511	788	31.38
> 2010	4844	1263	26.07
Morrow 2005-2007	1100	374	34
Jeevan 2012	55297	11032	20
Laghans 2010-2013	4118	725	17.6
Landercasper 2013	6725	1451	21.6
Morrow 2013-2015	2509	543	22
Phipott 2013-2015	562	110	19.6
Findlay-Shirras 2009-2012	2494	556	22.3
Hughes 2010-2012	581	146	25.13
Wilke 2004-2010	241597	74517	30.8
HeelanGladden 2010-2016	863	99	11.5
Shuk-Kay Tang 2016	2858	492	17.2
TOTAL			
≤ 2005	15861	4594	28.96
2005-2010	259943	79708	30.66
≥ 2010	93779	20016	21.34

Table 3: Re-operation rates for invasive breast cancer and ductal carcinoma *in-situ*.

Authors	Total BCS	Re-operation	
		Nb	%
INVASIVE			
van Leeuwen	25291	6557	25.9
Vos	32119	6241	19.4
Fisher	5659	1087	19.2
Our data	9599	2687	28
Jeevan	45793	8229	18
Wilke	193834	59218	30.5
Laghans	3391	454	13.4
Romics	578	60	10.4
Landercasper	6725	1451	21.6
Phipott	420	72	17.1
Hughes	515	127	24.7
HeelanGladden	395	71	17.97
Morrow	2509	543	22
TOTAL	326828	86797	26.56
			26.4-26.7
IN SITU			
Our data	1161	481	41.4
Jeevan	9504	2803	29.5
Wilke	44342	14490	32.68
Laghans	727	271	37.3
Romics	78	7	8.97
van Leeuwen	9167	3461	37.75
Phipott	106	34	32
Hughes	66	19	28.79
Heelan Gladden	110	28	25.4
TOTAL	65261	21594	33.09
			32.7-33.5

We analyzed literature studies to determined re-operation rate and type of re-operation, differences according to treatment periods, histologic tumor type and results after initial BCS with oncoplasty.

Methods

We included 15 studies with highest numbers of patients treated from 2002 to 2016 and our institutional data from our institutional data base including patients treated from year 1995 to 2016. Re-operation rates were determined for all studies, then according to treatment periods. Years of treatment were subdivided in three periods according to results reported in these studies: year 2005 and before, 2005-2010 and ≥ 2010 . For some studies a minor cross-over of years of treatment could be present. Re-operation rates were also analyzed for different histologic tumor types: DCIS, invasive carcinoma and different histology of invasive carcinomas, including ductal, lobular and others carcinomas.

Types of re-operation, re-excision and mastectomy rates were determined for all studies and also according to periods of treatment and histologic tumor types. A second re-operation with mastectomy could be required: rates of second mastectomy were also analyzed.

Table 4: Re-operation rates for ductal, lobular and others invasive breast cancers.

Authors	Total BCS	Re-operation	
		Nb	%
INVASIVE Ductal			
Our data	7278	1926	26.5
Vos	24493	4345	17.7
Wilke	168393	48179	28.6
Laghans	2748	360	13.1
Phipott	373	58	16
Hughes	470	108	22.98
Total	203755	54976	26.98
			26.8-27.2
INVASIVE Lobular			
Our data	1215	461	37.9
Vos	4067	1226	30.1
Wilke	13508	6021	44.6
Laghans	333	58	17.4
Phipott	47	14	30
Hughes	45	19	42.2
Total	19215	7799	40.59
			39.9-41.3
INVASIVE others			
Our data	1106	300	27.1
Vos	3559	670	18.8
Wilke	1013	301	29.7
Laghans	310	36	11.6
Total	5988	1307	21.83
			20.8-22.9

We specifically analyzed positive margins rates and positive or close margins rates for BCS with oncoplasty.

Results are presented with rates for each study and mean rates for all studies included in analysis, with confident interval 95% (CI

Table 5: Re-excisions and mastectomy rates.

Authors	Total BCS	Re-excision		Mastectomy		Re-excision+Mastectomy	
		Nb	%	Nb	%	Nb	%
Van Leeuwen	34458	5146	51.4	4872	48.6	770	14.96
Vos	32119	2368	37.9	3873	62.1		
Fisher	5659	556	51.1	531	48.9	84	15.1
Jeevan	55297	5943	10.7	4269	10.7		
Wilke	241597	46250	62.1	28267	37.9		
Laghans	4118	593	81.8	132	18.2	70	11.8
Landercasper	6725	1131	77.95	320	22		
Romics	656						
Morrow	2509	378	69.6	165	30.4		
Phipott	562	86	78.2	24	21.8		
Findlay-Shirras	2494						
Hughes	581						
Our data	10761	1523	48.1	1645	51.9	205	13.46
TOTAL	397536	63974	59.19	44098	40.8	1059	13.54
			58.9-59.5		40.5-41.1		12.8-14.3

95) and range.

Results

Re-operation rate was 27.49% (CI 95% 27.4 to 27.6, range: 10.2% to 34%) among 402357 patients with BCS for DCIS or invasive BC [3,5-18 and our institutional data's] (Table 1).

When analysis of re-operation rates were performed according to three periods of treatment, we observed a decreased of re-operation rates among successive periods from 28.96% (4594/15861, CI 95% 28.3 to 29.7) to 30.66% (79708/259943, CI 30.5 to 30.8) and 21.34% (20016/93779, CI 21.1 to 21.6) [3,5-11,13-18 and our data] (Table 2). In study reported by Morrow et al. [13], surgery after initial lumpectomy declined by 16% (p<0.001) from 2013 to 2015.

Re-operation rates were different for invasive BC and DCIS, respectively in literature review 26.56% (86797/326828, CI 26.4 to 26.7, range: 10.4 to 30.5) and 33.1% (21594/65261, CI 32.7 to 33.5, range: 8.97 to 41.4) [5-7,11,17 and our data] (Table 3). However, re-operation rates differed between histologic types of invasive BC: 26.98% for ductal invasive BC, 40.6% for lobular invasive BC and 21.83% for others invasive histologic types [6 and our data] (Table 4).

Mastectomy rates among 108446 patients with re-operation in literature review were 40.77% (CI 40.5 to 41.1, range: 10.7 to 62.1) (Table 5) and 55.4% (CI 54.6 to 56.2) for studies with analysis of a third intervention for mastectomy (8309/14998) [5,7,10 and our data's]. A third intervention for mastectomy had been reported in three studies [5,7,10] and our institutional data's: mastectomy rate after re-excision was 13.54% (1059/7818, CI 12.8 to 14.3) (Table 5).

When analysis of mastectomy rates were performed according to three periods of treatment (DCIS and invasive), we observed a decreased of mastectomy rates among successive periods from 59.62% (2739/4594, CI 58.2 to 61.0) to 48.8% (2532/5191, CI 47.4 to 50.2) and 36.81% (6892/17903, CI 36.1 to 37.5) [7,8,10,11,14,15 and our data] (Table 6). In study reported by Wilke et al. [9] mastectomy rate was 37.9% for patients operated between 2004 and 2010.

Mastectomy rates were different according to histologic types of tumor: 49.7% (1960/3942, CI 48.1 to 51.3) for DCIS [3,5,8-10,12,15,17 and our data], 50.9% (9446/18566, CI 50.2 to 51.6) for invasive BC

Table 6: Re-excisions and mastectomy rates according to three periods.

Authors	Total BCS	Re-excision		Mastectomy	
		Nb	%	Nb	%
Fisher 2002-2005	2586	207	41.15	296	58.85
2006-2009	3073	265	45.38	319	54.62
van Leeuwen 2002-2005	9868	1282	43.11	1692	56.9
2006-2009	11662	1805	52.39	1640	47.6
2010-2013	12928	2059	57.21	1540	42.8
Our data 1995-2004	3407	366	32.77	751	67.2
2005-2010	2511	336	42.64	452	57.4
> 2010	4844	821	65	442	35
Morrow 2005-2007	1100	253	67.7	121	32.3
Jeevan 2012	55297	5943	58.2	4269	41.8
Laghans 2010-2013	4118	593	81.8	132	18.2
Landercasper 2013	6725	1131	77.95	320	22.05
Morrow 2013-2015	2509	378	69.6	165	30.4
Phipott 2013-2015	562	86	78.2	24	21.8
TOTAL					
≤ 2005	15861	1855	40.38	2739	59.62
2005-2010	18346	2659	51.2	2532	48.8
≥ 2010	86983	11011	58.81	6892	36.81

Table 7: Re-excisions and mastectomy rates for invasive breast cancer and ductal carcinoma *in-situ*.

Authors	Total BCS	Re-excision		Mastectomy	
		Nb	%	Nb	%
INVASIVE					
van Leeuwen	25291	3404	51.9	3153	48.1
Vos	32119	2368	37.9	3873	62.1
Fisher	5659	556	51.1	531	48.9
Our data	9599	1283	47.7	1404	52.3
Landercasper	6725	1131	77.95	320	22
Morrow	2509	378	69.6	165	30.4
TOTAL	81902	9120	49.12	9446	50.88
					48.4-49.8
IN SITU					
Our data	1161	240	49.9	241	50.1
van Leeuwen	9167	1742	50.3	1719	49.7
TOTAL	10328	1982	50.3	1960	49.7
					48.7-51.9

(Table 7) and respectively: 55.7% (CI 54.5 to 56.9) for ductal invasive BC, 70.5% (CI 68.3 to 72.7) for lobular invasive BC and 60.9% (CI 57.8 to 64.0) for others invasive histologic types [6 and our data], (Table 8).

After initial surgery with oncoplasty, close or positive margins was reported in 12.3% (342/2772, CI 11.1 to 13.5) in a meta-analysis reported in 2014 [19] and mastectomy rate for re-operation after initial resection with oncoplasty were high: 64% in Clough et al study [20] and 61.3% in Losken meta-analysis [19].

In literature review [21-53], positive margins rate after first

Table 8: Re-excisions and mastectomy rates for ductal, lobular and others invasive breast cancers.

Authors	Total BCS	Re-excision		Mastectomy	
		Nb	%	Nb	%
INVASIVE Ductal					
Our data	7278	978	50.8	948	49.2
Vos	24493	1797	41.36	2548	58.64
Total	31771	2775	44.25	3496	55.75
					43.1-45.5
INVASIVE Lobular					
Our data	1215	172	37.3	289	62.7
Vos	4067	325	26.51	901	73.49
Total	5282	497	29.46	1190	70.54
					27.3-31.7
INVASIVE others					
Our data	1106	133	44.3	167	55.7
Vos	3559	246	36.72	424	63.28
Total	4665	379	39.07	591	60.93
					36-42.2

conservative surgery with oncoplasty was 2.04% (69/3383, CI 1.6 to 2.5, range: 0 to 7.4) (Table 9). Close or positive margins after first conservative surgery with oncoplasty were reported in 11.8% (322/2730, CI 10.6 to 13.0, range: 2.0 to 18.9) and 12.3% (342/2772, CI 11.1 to 13.5) in a meta-analysis reported in 2014 (Table 10).

Discussion

Re-operation rates differ between studies from 10.2% to 34% in relation with several factors reported in introduction, mainly due to no clear consensus regarding the definition of sufficient margins, patient's choice and tumor versus breast volume [3,4].

A decrease of re-operation rate was reported about 9% for absolute rate during the last period from year 2010 in comparison with older periods corresponding to 30% relative decreased. The higher re-operation rate was observed for lobular invasive BC, then for DCIS, with lesser rates for ductal invasive carcinomas and others histologic types (*i.e.*, tubular, mucinous and medullar carcinomas).

For DCIS, the usual margin required is 2 mm. However, for DCIS, there was no statistical significant difference in Loco-Regional Recurrence (LRR) for patients with margins <2 mm *vs.* ≥ 2 mm who received radiotherapy, (10-year LRR 4.8% *vs.* 3.3%, respectively; p=0.72) [54]. One other large study evaluating the relationship between margin width and recurrence of did not identify a significant association of recurrence with margin width of ≤ 2 mm compared with larger margins for patients receiving radiotherapy [55]. However, Morrow et al. [56] reported in 2016 that 2 mm margin minimizes the risk of Ipsilateral Breast Tumor Recurrence (IBTR) compared with smaller negative margins, using a meta-analysis of margin width and IBTR from a systematic review.

It is also interesting to report that surgeons treating more than 50 BC annually were significantly more likely to report that margin with "no ink on tumor" was as adequate (85%) compared with those treating 20 cases or fewer (55%) (p<0.001) [13].

A conservative re-operation was possible for about 50% of patients

Table 9: Positives margins rates for initial surgery with oncoplasty.

Oncoplasty			Positive margins	
Authors	Year	Nb total	Nb	%
Nizet	2015	72	0	0
Roth	2014	134	0	0
Caruso	2008	61	0	0
Ballester	2009	86	4	4.7
Maguire	2013	79	0	0
Gendy	2003	49	0	0
Losken	2004	39	0	0
Silverstein	2015	311	12	3.7
Eaton	2014	86	0	0
Schrenk	2006	121	0	0
Chang	2004	37	0	0
Munhoz	2006	74	0	0
Losken	2007	63	0	0
McCulley	2005	50	0	0
Nos	1998	50	3	6
Fitoussi	2010	540	40	7.4
Chakravorty	2012	146	0	0
Caruso	2011	50	1	2
Meretoja	2010	68	0	0
Rietjens	2007	148	7	4.7
Grubnik	2013	251	0	0
Bogusevicius	2014	60	0	0
Down	2013	37	0	0
Kronowitz	2006	50	0	0
Tenofsky	2006	58	0	0
Hamdi	2013	119	0	0
Munhoz	2011	106	2	1.8
Bamford	2015	68	0	0
Chang	2012	79	0	0
Munhoz	2009	218	0	0
Munhoz	2006	39	0	0
Munhoz	2006	34	0	0
Total		3383	69	2.04

with DCIS or ductal invasive BC and lesser for lobular invasive BC (about 30%) with a decrease of mastectomy rates among successive periods analyzed. Mastectomy rates decreased with an absolute rate of about 23% from the first to the last period, corresponding to 38% relative decreased. However, about 13% to 14% of patients need a third operation with mastectomy. This rate is important in order to inform patients of this risk when a re-excision is planned. As it was observed higher re-operation rate for lobular invasive carcinoma, mastectomy rate was also higher: about 10% absolute rate more and 20% increased relative risk. Finally, mastectomy rate after initial BCS with oncoplasty is high, more than 60%, due to impossibility of a new conservative surgery with acceptable cosmetic results and higher risk of local recurrence. However, for patients with BCS for invasive carcinomas and clear margins, the main factor of local recurrence was molecular-like tumor sub-type [57].

Table 10: Closes or positives margins for initial surgery with oncoplasty.

Oncoplasty			Close-Positive margins	
Authors	Year	Nb total	Nb	%
Clough	2018	350	44	12.6
Romics	2018	656	67	10.2
Mazouni	2013	45	14	31
McCulley	2005	50	4	8
Rietjens	2007	148	8	5.4
Fitoussi	2010	540	102	18.9
Chakravorty	2012	150	10	6.6
Grubnik	2013	251	5	2
Eaton	2014	86	15	17.4
De Lorenzi	2016	454	53	11.7
Total		2730	322	11.79
Losken	2014	2772	342	12.3

Conclusion

Re-operation rate decrease progressively across successive periods (relative decrease of 30%) and mastectomy rate also decrease progressively (relative decrease of 38%). Consequently, a strong decrease of mastectomy rate was reported for an initial cohort of patients with BCS. In next year's, with more accurate pre-operative radiologic analysis, new techniques of per-operative margin analysis and application of guidelines with "no ink on tumor", a decrease of re-operation rate and mastectomy rate is probable. This application of standard for adequate margins has the potential to improve cosmetic outcomes, and decrease health care costs. However, the mastectomy rate is high for lobular invasive carcinoma and after initial resection with oncoplasty and patient's information for a risk of a third operation with mastectomy should be done in case of re-operation.

References

- Forissier V, Tallet A, Cohen M, Classe JM, Reyat F, Chopin N, et al. Is post-mastectomy radiation therapy contributive in pN0-1mi breast cancer patients? Results of a French multi-centric cohort. *Eur J Cancer*. 2017;87:47-57.
- Chagpar AB, Killelea BK, Tsangaris TN, Butler M, Stavris K, Li F, et al. A randomized, controlled trial of cavity shave margins in breast cancer. *N Engl J Med*. 2015;373(6):503-10.
- Hughes L, Hamm J, Mcgahan C, Baliski C. Surgeon volume, patient age, and tumor-related factors influence the need for Re-Excision after breast conserving surgery. *Ann Surg Oncol*. 2016;23(Suppl 5):656-64.
- Pleijhuis RG, Graafland M, de Vries J, Bart J, de Jong JS, van Dam GM. Obtaining adequate surgical margins in breast-conserving therapy for patients with early-stage breast cancer: current modalities and future directions. *Ann Surg Oncol*. 2009;16(10):2717-30.
- van Leeuwen MT, Falster MO, Vajdic CM, Crowe PJ, Lujic S, Klaes E, et al. Reoperation after breast-conserving surgery for cancer in Australia: statewide cohort study of linked hospital data. *BMJ Open*. 2018;8(4):e020858.
- Vos EL, Siesling S, Baaijens MH, Verhoef C, Jager A, Voogd AC, et al. Omitting re-excision for focally positive margins after breast-conserving surgery does not impair disease-free and overall survival. *Breast Cancer Res Treat*. 2017;164:157-67.
- Fisher S, Yasui Y, Dabbs K, Winget M. Re-excision and survival following breast conserving surgery in early stage breast cancer patients: a population-based study. *BMC Health Serv Res*. 2018;18:94.

8. Jeevan R, Cromwell DA, Trivella M, Lawrence G, Kearins O, Pereira J, et al. Reoperation rates after breast conserving surgery for breast cancer among women in England: retrospective study of hospital episode statistics. *BMJ*. 2012;345:e4505.
9. Wilke LG, Czechura T, Wang C, Lapin B, Liederbach E, Winchester DP, et al. Repeat surgery after breast conservation for the treatment of stage 0 to II breast carcinoma: a report from the National Cancer Data Base, 2004-2010. *JAMA Surg*. 2014;149(12):1296-305.
10. Langhans L, Jensen MB, Talman MM, Vejborg I, Kroman N, Tvedskov TF. Reoperation Rates in Ductal Carcinoma In Situ vs Invasive Breast Cancer After Wire-Guided Breast-Conserving Surgery. *JAMA Surg*. 2017;152(4):378-84.
11. Landercasper J, Whitacre E, Degnim AC, Al-Hamadani M. Reasons for re-excision after lumpectomy for breast cancer: insight from the American Society of Breast Surgeons Mastery(SM) database. *Ann Surg Oncol*. 2014;21(10):3185-91.
12. Romics L, Macaskill EJ, Fernandez T, Simpson L, Morrow E, Pitsinis V, et al. A population-based audit of surgical practice and outcomes of oncoplastic breast conservations in Scotland - An analysis of 589 patients. *Eur J Surg Oncol*. 2018;44(7):939-44.
13. Morrow M, Abrahamse P, Katz SJ. Trend Analysis on Reoperation After Lumpectomy for Breast Cancer-Reply. *JAMA Oncol*. 2018;4(5):747.
14. Morrow M, Jagsi R, Alderman AK, Griggs JJ, Hawley ST, Hamilton AS, et al. Surgeon recommendations and receipt of mastectomy for treatment of breast cancer. *JAMA*. 2009;302(14):1551-6.
15. Philpott A, Wong J, Elder K, Gorelik A, Mann GB, Skandarajah A. Factors influencing reoperation following breast-conserving surgery. *ANZ J Surg*. 2018;88(9):922-7.
16. Findlay-Shirras LJ, Outbih O, Muzyka CN, Galloway K, Hebbard PC, Nashed M. Predictors of residual disease after breast conservation surgery. *Ann Surg Oncol*. 2018;25(7):1936-42.
17. Heelan Gladden AA, Sams S, Gleisner A, Finlayson C, Kounalakis N, Hosokawa P, et al. Re-excision rates after breast conserving surgery following the 2014 SSO-ASTRO guidelines. *Am J Surg*. 2017;214(6):1104-9.
18. Tang SS, Kaptanis S, Haddow JB, Mondani G, Elsberger B, Tasoulis MK, et al. Current margin practice and effect on re-excision rates following the publication of the SSO-ASTRO consensus and ABS consensus guidelines: a national prospective study of 2858 women undergoing breast-conserving therapy in the UK and Ireland. *Eur J Cancer*. 2017;84:315-24.
19. Losken A, Dugal CS, Styblo TM, Carlson GW. A meta-analysis comparing breast conservation therapy alone to the oncoplastic technique. *Ann Plast Surg*. 2014;72(2):145-9.
20. Clough KB, van la Parra RFD, Thygesen HH, Levy E, Russ E, Halabi NM, et al. Long-term Results After Oncoplastic Surgery for Breast Cancer: A 10-year Follow-up. *Ann Surg*. 2018;268(1):165-71.
21. Nizet JL, Maweja S, Lakosi F, Lifrange E, Scagnol I, Seidel L, et al. Oncological and surgical outcome after oncoplastic breast surgery. *Acta Chir Belg*. 2015;115:33-41.
22. Roth AM, Kauer-Dorner D, Resch A, Schmid A, Thill M, Niehoff P, et al. Is oncoplastic surgery a contraindication for accelerated partial breast radiation using the interstitial multicatheter brachytherapy method? *Brachytherapy*. 2014;13(4):394-9.
23. Caruso F, Catanuto G, De Meo L, Ferrara M, Gallodoro A, Petrolito E, et al. Outcomes of bilateral mammoplasty for early stage breast cancer. *Eur J Surg Oncol*. 2008;34(10):1143-7.
24. Ballester M, Berry M, Couturaud B, Reyat F, Salmon RJ, Fitoussi AD. Lateral mammoplasty reconstruction after surgery for breast cancer. *Br J Surg*. 2009;96(10):1141-6.
25. Maguire PD, Adams A, Nichols MA. Oncoplastic surgery and radiation therapy for breast conservation: early outcomes. *Am J Clin Oncol*. 2015;38(4):353-7.
26. Gendy RK, Able JA, Rainsbury RM. Impact of skin-sparing mastectomy with immediate reconstruction and breast-sparing reconstruction with miniflaps on the outcomes of oncoplastic breast surgery. *Br J Surg*. 2003;90(4):433-9.
27. Losken A, Schaefer TG, Carlson GW, Jones GE, Styblo TM, Bostwick J 3rd. Immediate endoscopic latissimus dorsi flap: risk or benefit in reconstructing partial mastectomy defects. *Ann Plast Surg*. 2004;53:1-5.
28. Silverstein MJ, Savalia N, Khan S, Ryan J. Extreme oncoplasty: breast conservation for patients who need mastectomy. *Breast J*. 2015;21:52-9.
29. Eaton BR, Losken A, Okwan-Duodu D, Schuster DM, Switchenko JM, Mister D, et al. Local recurrence patterns in breast cancer patients treated with oncoplastic reduction mammoplasty and radiotherapy. *Ann Surg Oncol*. 2014;21:93-9.
30. Schrenk P, Huemer GM, Sir A, Moser F, Wayand W. Tumor quadrantectomy combined with reduction mammoplasty for the treatment of breast cancer. *Eur Surg*. 2006;38(6):424-32.
31. Chang E, Johnson N, Webber B, Booth J, Rahhal D, Gannett D, et al. Bilateral reduction mammoplasty in combination with lumpectomy for treatment of breast cancer in patients with macromastia. *Am J Surg*. 2004;187(5):647-50.
32. Munhoz AM, Montag E, Arruda EG, Aldrighi C, Gemperli R, Aldrighi JM, et al. Critical analysis of reduction mammoplasty techniques in combination with conservative breast surgery for early breast cancer treatment. *Plast Reconstr Surg*. 2006;117(4):1091-103.
33. Losken A, Styblo TM, Carlson GW, Jones GE, Amerson BJ. Management algorithm and outcome evaluation of partial mastectomy defects treated using reduction or mastopexy techniques. *Ann Plast Surg*. 2007;59(3):235-42.
34. McCulley SJ, Macmillan RD. Therapeutic mammoplasty--analysis of 50 consecutive cases. *Br J Plast Surg*. 2005;58(7):902-7.
35. Nos C, Fitoussi A, Bourgeois D, Fourquet A, Salmon RJ, Clough KB. Conservative treatment of lower pole breast cancers by bilateral mammoplasty and radiotherapy. *Eur J Surg Oncol*. 1998;24(6):508-14.
36. Fitoussi AD, Berry MG, Famà F, Falcou MC, Curnier A, Couturaud B, et al. Oncoplastic breast surgery for cancer: analysis of 540 consecutive cases [outcomes article]. *Plast Reconstr Surg*. 2010;125(2):454-62.
37. Chakravorty A, Shrestha AK, Sanmugalingam N, Rapisarda F, Roche N, Querci Della Rovere G, et al. How safe is oncoplastic breast conservation? Comparative analysis with standard breast conserving surgery. *Eur J Surg Oncol*. 2012;38(5):395-8.
38. Caruso F, Ferrara M, Castiglione G, Cannata I, Marziani A, Polino C, et al. Therapeutic mammoplasties: full local control of breast cancer in one surgical stage with frozen section. *Eur J Surg Oncol*. 2011;37(10):871-5.
39. Meretoja TJ, Svarvar C, Jahkola TA. Outcome of oncoplastic breast surgery in 90 prospective patients. *Am J Surg*. 2010;200(2):224-8.
40. Rietjens M, Urban CA, Rey PC, Mazzarol G, Maisonneuve P, Garusi C, et al. Long-term oncological results of breast conservative treatment with oncoplastic surgery. *Breast*. 2007;16(4):387-95.
41. Grubnik A, Benn C, Edwards G. Therapeutic mammoplasty for breast cancer: oncological and aesthetic outcomes. *World J Surg*. 2013;37:72-83.
42. Bogusevicius A, Cepulienė D, Sepetauskiene E. The integrated evaluation of the results of oncoplastic surgery for locally advanced breast cancer. *Breast J*. 2014;20:53-60.
43. Down SK, Jha PK, Burger A, Hussien MI. Oncological advantages of oncoplastic breast-conserving surgery in treatment of early breast cancer. *Breast J*. 2013;19:56-63.

44. Kronowitz SJ, Feledy JA, Hunt KK, Kuerer HM, Youssef A, Koutz CA, et al. Determining the optimal approach to breast reconstruction after partial mastectomy. *Plast Reconstr Surg.* 2006;117:1-11.
45. Tenofsky PL, Dowell P, Topalovski T, Helmer SD. Surgical, oncologic, and cosmetic differences between oncoplastic and non oncoplastic breast conserving surgery in breast cancer patients. *Am J Surg.* 2014;207(3):398-402.
46. Hamdi M. Oncoplastic and reconstructive surgery of the breast. *Breast.* 2013;22(Suppl 2):S100-5.
47. Munhoz AM, Aldrighi CM, Montag E, Arruda E, Brasil JA, Filassi JR, et al. Outcome analysis of immediate and delayed conservative breast surgery reconstruction with mastopexy and reduction mammoplasty techniques. *Ann Plast Surg.* 2011;67(3):220-5.
48. Bamford R, Sutton R, McIntosh J. Therapeutic mammoplasty allows for clear surgical margins in large and multifocal tumours without delaying adjuvant therapy. *Breast.* 2015;24(2):171-4.
49. Chang EI, Peled AW, Foster RD, Lin C, Zeidler KR, Ewing CA, et al. Evaluating the feasibility of extended partial mastectomy and immediate reduction mammoplasty reconstruction as an alternative to mastectomy. *Ann Surg.* 2012;255(6):1151-7.
50. Munhoz AM, Montag E, Arruda E, Aldrighi CM, Filassi JR, Piato JR, et al. Immediate reconstruction following breast-conserving surgery: management of the positive surgical margins and influence on secondary reconstruction. *Breast.* 2009;18(1):47-54.
51. Munhoz AM, Montag E, Arruda EG, Aldrighi C, Gemperli R, Aldrighi JM, et al. Superior-medial dermoglandular pedicle reduction mammoplasty for immediate conservative breast surgery reconstruction: technical aspects and outcome. *Ann Plast Surg.* 2006;57(5):502-8.
52. Mazouni C, Naveau A, Kane A, Dunant A, Garbay JR, Leymarie N, et al. The role of oncoplastic breast surgery in the management of breast cancer treated with primary chemotherapy. *Breast.* 2013;22:1189-93.
53. De Lorenzi F, Hubner G, Rotmensz N, Bagnardi V, Loschi P, Maisonneuve P, et al. Oncological results of oncoplastic breast-conserving surgery: long term follow-up of a large series at a single institution. A matched-cohort analysis. *Eur J Surg Oncol.* 2016;42:71-7.
54. Kuerer HM, Smith BD, Chavez-MacGregor M, Albarracin C, Barcenas CH, Santiago L, et al. DCIS margins and breast conservation: MD Anderson cancer center multidisciplinary practice guidelines and outcomes. *J Cancer.* 2017;8(14):2653-62.
55. Van Zee KJ, Subhedar P, Olcese C, Patil S, Morrow M. Relationship between margin width and recurrence of ductal carcinoma in situ: analysis of 2996 women treated with breast-conserving surgery for 30 years. *Ann Surg.* 2015;262(4):623-31.
56. Morrow M, Van Zee KJ, Solin LJ, Houssami N, Chavez-MacGregor M, Harris JR, et al. Society of Surgical Oncology-American Society for Radiation Oncology-American Society of Clinical Oncology Consensus Guideline on Margins for Breast-Conserving Surgery with Whole-Breast Irradiation in Ductal Carcinoma in Situ. *Ann Surg Oncol.* 2016;23(12):3801-3810.
57. Houvenaeghel G, de Nonneville A, Cohen M, Classe JM, Reyat F, Mazouni C, et al. Isolated ipsilateral local recurrence of breast cancer: predictive factors and prognostic impact. *Breast Cancer Res Treat.* 2018.