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Reducing the Use of Frozen Section for Sentinel Node Biopsy in Breast Carcinoma: Feasibility and Outcome

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Abstract. *Background/Aim: Sentinel lymph node biopsy (SLNB) is a standard practice for staging the axilla in breast cancer. Initially, intraoperative frozen section (FS) examination was used but was time-consuming and often provided false-negative results. Delayed permanent section (PS) analysis is currently performed; FS-SLNB is maintained for selected high-risk cases. The aim of this study was to evaluate the feasibility of this approach. Patients and Methods: All patients with breast cancer with clinically negative lymph nodes undergoing SLNB at our institution from 2004 to 2020 were analyzed, comparing operative time, re-operation rate and clinical outcome in terms of regional lymphatic recurrence-free and overall survival by type of SLNB (FS vs. PS). Results: FS-SLNB comprised 100% of the procedures in 2004 and 18.2% at the end of the study period. The use of PS-SLNB instead of FS-SLNB was associated with a significantly reduced rate of axillary dissection (AD): 4.4% vs. 27.2, respectively (p<0.001). There was no significant difference in re-operation rate for AD: 3.9% vs. 6.9%, respectively (p=0.20). The use of PS-SLNB significantly reduced the operative time (mean=51 minutes) (p<0.001). After a mean follow-up of 70.9 months (range=16-180 months) there were no differences in regional lymphatic recurrence free or overall survival. Conclusion: The reduced use of FS-SLNB resulted in a significantly lower rate of AD, and significant operative time and costs savings, without any increase in the reoperation rate and lymphatic recurrences. Therefore, this approach is feasible, safe and beneficial, both for patients and healthcare services.*

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Key Words: Axillary staging, axillary dissection, micrometastasis, regional lymphatic recurrence, operative time, re-operation rate.

Sentinel node biopsy (SLNB) was introduced into the surgical management of invasive breast carcinoma approximately 20 years ago (1). At present, SLNB is considered the standard worldwide for staging the axilla (2). Thanks to this procedure, the number of complete axillary dissections (ADs) in the treatment of breast cancer has dramatically fallen, with considerable advantages for patients in terms of reduced incidence of surgical sequelae. In fact, pain, impairment of arm motility and lymphedema are significantly less frequent among patients undergoing SLNB instead of AD (3-5). On the other hand, the introduction of SLNB was associated with increased technical complexity and prolonged operative time due to the need for frozen section (FS) examination of the sentinel lymph node. In addition, the FS evaluation of SLNB suffers from a relevant false-negative rate, with sensitivity ranging from 41% to 91% (6-10). For these reasons, a progressive trend for the reduction in the use of FS evaluation of SNBs has taken place at many institutions, including ours. FS-SLNB was further discouraged after the publication of the ACOSOG Z0011 trial. In fact, the Z0011 trial showed that a second operation to complete AD in patients with up to two sentinel nodes with macro-metastasis did not result in any survival advantage who then underwent subsequent radiotherapy and systemic treatment (11). The use of preoperative axillary ultrasound with core-biopsy of suspicious lymph nodes, along with evaluation of other clinical and pathological parameters (12-17) also contributed to the identification of patients with axillary metastasis in the preoperative work-up, further reducing the number of patients candidates for FS-SLNB. The aims of the current study were to retrospectively analyze the approach to SLNB in breast cancer at our Institution over time and to compare the outcome of patients submitted to FS-SLNB with those who underwent permanent section (PS) examination of SLNB in terms of the reintervention rate and locoregional recurrence-free survival, as well as overall survival.

Patients and Methods

Patients. All patients with histologically proven invasive breast carcinoma without evidence of lymph node metastasis (cN0) who underwent surgery with SLNB at our Institution between April 2004 and April 2020 and subsequent follow-up at our clinic were included in the study. Patients with ductal carcinoma *in situ* and final diagnosis of occult breast carcinoma were not included. Patients who underwent prophylactic mastectomy with SLNB were also not considered, nor those with overt axillary metastasis who underwent direct complete AD. Patients signed a written-informed consent to use of their data for study purposes at the time of surgery. This was a retrospective study and no experimental treatment was given.

Compliance with ethical standards. The study complied with the Ethical Principles for Medical Research Involving Human Subjects according to the World Medical Association Declaration of Helsinki and was approved by the local Ethics Committee (Regione Toscana, Area vasta Centro, #15.018_AOUC).

Clinical and histological parameters recorded. Data for each patient were retrieved from the clinical records, including age at diagnosis, histological type, grade of differentiation, hormonal receptor status, human epidermal growth factor receptor 2 (HER2) status, Ki-67 index, lymphovascular invasion and American Joint Committee on Cancer stage (18). Type of surgery (breast-conserving or mastectomy) as well as type of SLNB (FS or PS) were recorded. Concerning the pathological results of the SLNB, cases with no evidence of tumor or with the presence of isolated tumor cells in the lymph nodes were considered negative, whereas cases with micrometastasis (0.2-2 mm) or macrometastasis (>2 mm) were considered positive. In the case of a positive SLNB, we then recorded the subsequent management (intraoperative AD, delayed AD, follow-up). For each patient, the type of adjuvant treatment was also recorded. All cases were followed-up with clinical examination every 6 months and with mammography and breast-axillary ultrasound every 12 months. All cases suspicious for recurrence were submitted to ultrasound-guided breast or axillary lymph-node core biopsy. For the purpose of this study, all regional (lymphatic) recurrences were recorded and the regional recurrence-free survival was calculated from the date of the primary surgery to the date of detection of any regional recurrence or to the last follow-up, according to the management of the SLNB. In addition, overall survival was evaluated for all patients.

Statistical analysis. Data analysis was performed using IBM SPSS Statistics, version 27.0 (IBM, Armonk, NY, USA). The frequency distribution was assessed by Fisher's exact test or by chi-square test, as appropriate. Differences in the mean operative time were evaluated by Student *t*-test. Regional recurrence-free interval and overall survival were calculated according to Kaplan–Meier method and evaluated by log-rank test.

Results

Overall, 413 patients satisfied the inclusion criteria. Because some of them had bilateral breast carcinoma or developed a subsequent contralateral cancer during the study period, a total of 422 breast cancers with SLNB were analyzed. The type of surgery, the management of the SLNB (FS or PS), as well as use of neoadjuvant or adjuvant treatments are detailed in Table I. For the purpose of the study, the whole series was divided into two groups according to the management of SLNB: Group 1, FS, and group 2, PS.

Table I. *Distribution of patients by type of surgery, type of sentinel lymph node biopsy (SLNB) and use of neoadjuvant or adjuvant treatments.*

		Frequency (%)
Treatment	Mastectomy	84 (19.9)
	Conservative surgery	338 (80.1)
SLNB	Frozen section	217 (51.4)
	Permanent section	205 (48.6)
Neoadjuvant treatment	Yes	31 (7.3)
	No	391 (92.7)
Adjuvant treatment	Radiotherapy	344 (81.5)
	Hormone therapy	321 (76.1)
	Chemotherapy	120 (28.4)
	Trastuzumab	47 (11.1)
	Total	422 (100.0)

In The FS group, 46 patients (21.2%) directly underwent complete AD because of metastasis in the SN. The remaining 171 patients (78.8%) had a negative result of the FS. Among these, absence of metastasis was confirmed in 139 cases (81.3%) by the subsequent definitive pathological report (true-negative), whereas in 32 patients (18.7%), the final result showed presence of metastasis (false-negative). In this latter group, 15 patients (10 with micrometastasis and five with macrometastasis) underwent reintervention for complete AD, whereas in 17 patients (14 with micrometastasis and three with macrometastasis), it was decided to avoid reintervention and to start follow-up (Figure 1). The 10 cases with micrometastasis which underwent delayed AD were observed in the years 2004-2010, before the futility of AD in the case of SLN with micrometastasis was demonstrated.

In the PS group, 173 patients (84.4%) started follow-up due to the absence of metastasis. The remaining 32 patients (15.6%) had metastasis in the SLNB, but among these only eight patients (25.0%) underwent reintervention for complete AD because of macrometastasis; one patient underwent direct complete AD because of macroscopic pathological appearance of the SN; in 23 patients (71.9%) it was decided to start follow-up despite the positive result (18 with micrometastasis and five with macrometastasis) (Figure 2). All patients with macrometastasis in the SLN who immediately started follow-up received adjuvant radiotherapy after breast-conserving surgery.

The mean age of the study population was 58.5 years (median=58 years, range=26-88 years). The proportion of young women (≤40 years), as well as the distribution according to clinicopathological parameters in the two groups are shown in Table II.

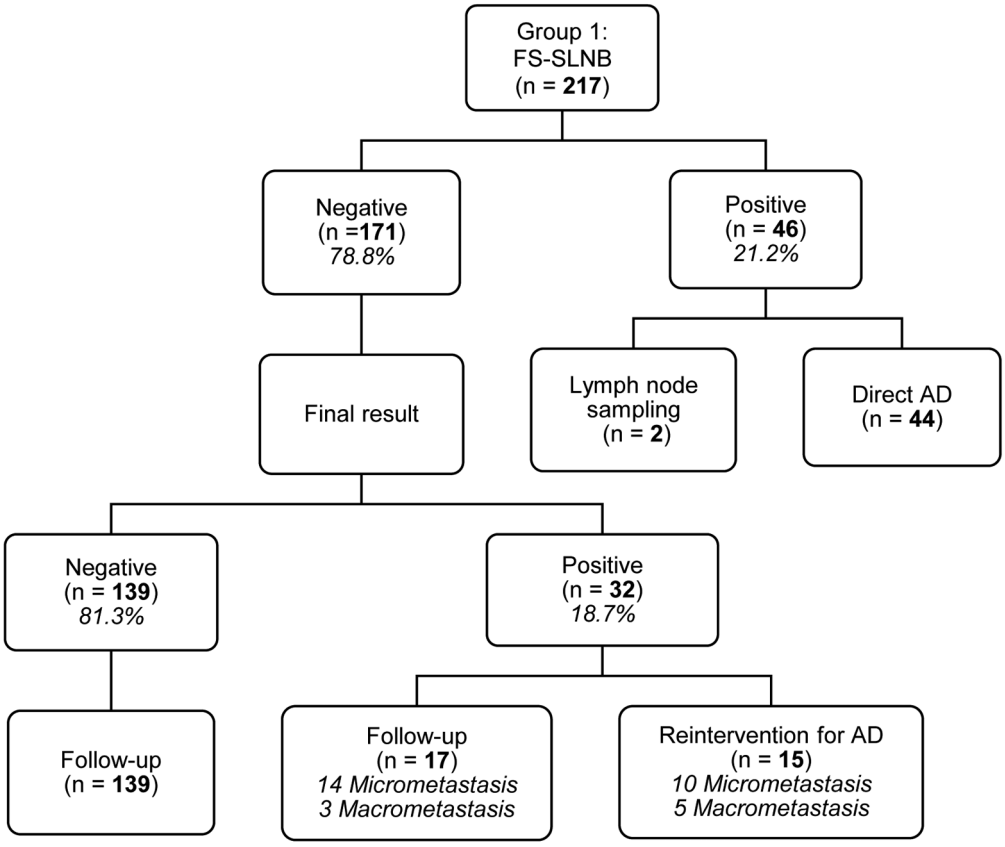

Figure 1. *Management of patients in frozen section sentinel lymph node biopsy (FS-SLNB) according to FS results. AD: Axillary lymph node dissection.*

We then evaluated the variation in the proportion of patients submitted to FS-SLNB and PS-SLNB during the study period (2004-2020) (Figure 3). It is clear that there was an inversion in the management of SLNB (FS *vs*. PS) taking place around the year 2010.

Therefore, we also analyzed the outcome of the two approaches to SLNB according to the period of time. For this purpose, we divided our series into two groups by time: years 2004-2010, 148 patients; and years 2011-2020, 274 patients. The distribution according to clinicopathological parameters in the two groups is shown in Table III. The use of FS-SLNB decreased significantly from 89.9% (133/148) in the years 2004-2010 to 30.6% (84/274) in the years 2011-2020; $p<0.001$.

Type of SLNB and rate of complete AD. The choice of PS-SLNB was associated with a significantly reduced rate of AD [59/217 (27.2%) in the FS-SLNB group *vs*. only 9/205 (4.4%), in the PS-SLNB group; $p<0.001$]. As a consequence, the rate of complete AD significantly dropped from 25.0% (37/148) in the years 2004-2010 to 11.3% (31/274) in the years 2011-2020 ($p<0.001$).

Reintervention rate for complete AD according to type of SLNB. Overall, 23 out of 422 patients (5.4%) underwent reintervention for AD. The reintervention rate was 6.9% (15/217) in the FS-SLNB group *vs*. 3.9% (8/205) in the PS-SLNB group. The 15 reinterventions in the FS-SLNB group were due to false-negative results of the FS, whereas the eight reinterventions in the PS-SLNB group were obviously due to presence of metastasis in the SLN.

Type of SLNB and operative time. We further evaluated the mean operative time of all the surgical procedures according to the type of SLNB performed. The patients submitted to FS-SLNB had a significantly longer operative time in comparison to those undergoing PS-SLNB: 110.9±42.1 minutes *vs*. 60.2±22.0 minutes, respectively ($p<0.001$). The choice of PS-SLNB, on average, allowed an operative time saving of approximately 51 minutes.

Type of SLNB and incidence of regional lymph node recurrence. To assess whether the use of PS-SLNB instead of FS-SLNB influenced the risk of regional lymph node recurrence, we analyzed the lymph node recurrence-free

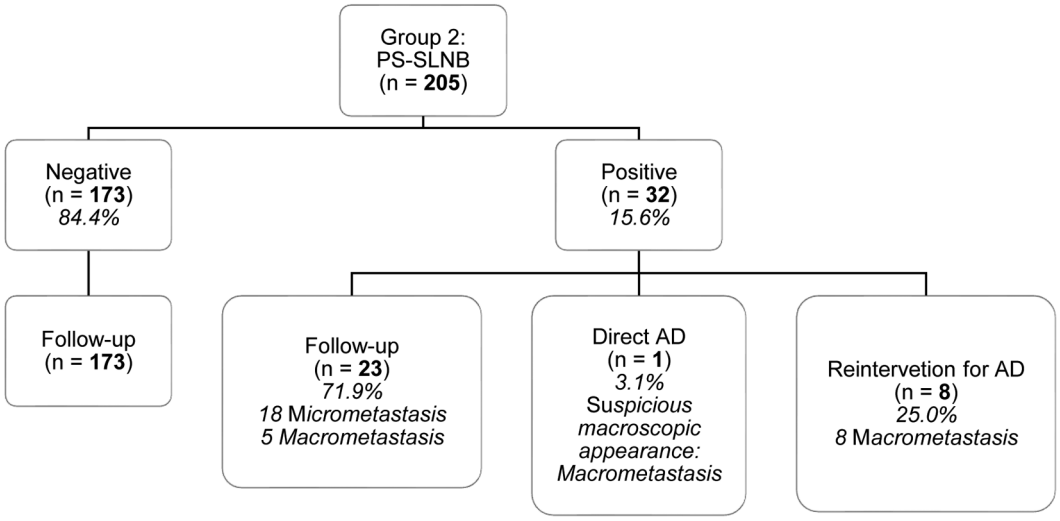

Figure 2. *Management of patients in permanent section sentinel lymph node biopsy (PS-SLNB) according to PS results. AD: Axillary lymph node dissection.*

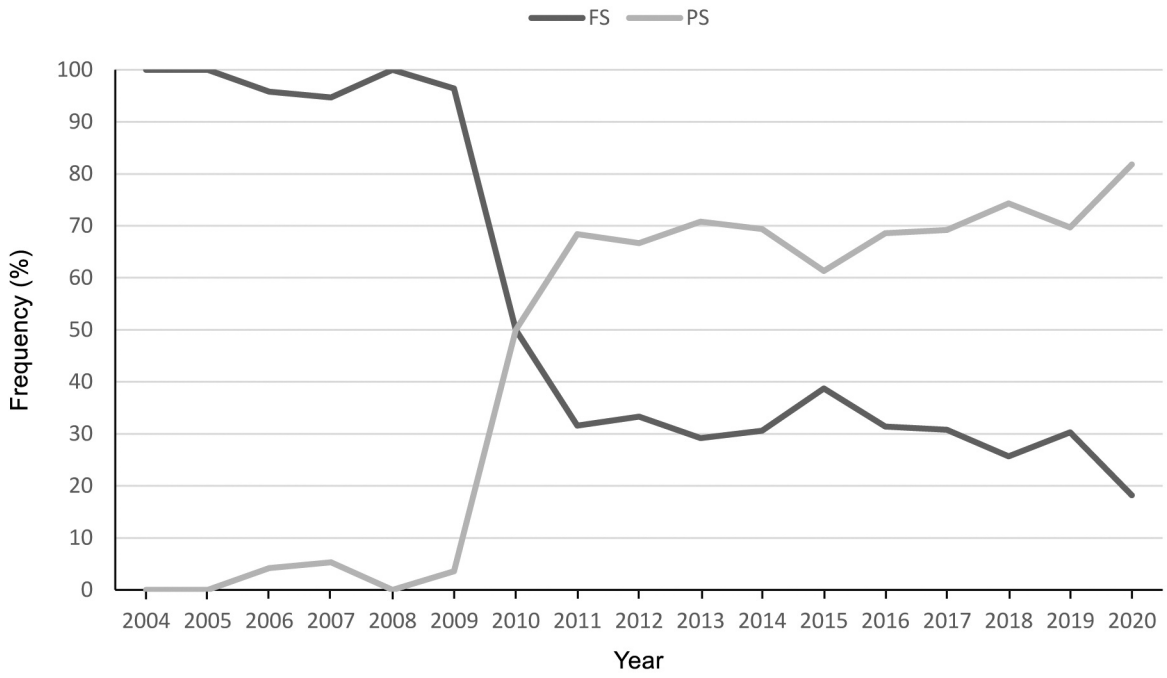

Figure 3. *Sentinel lymph node biopsy type by year of surgery. FS: Frozen section; PS: permanent section.*

survival in our series. Overall, we had nine lymph node recurrences (2.1%). Regional lymph node recurrences occurred after a mean of 46.8±36.4 months. Regional recurrence occurred in 3.7% (8/217) in the FS-SLNB group and in 0.5% (1/205) in the PS-SLNB group (p=0.03). Overall, there was no difference in recurrence-free survival between the patients treated in the years 2004-2010 and those treats in 2011-2020 (Figure 4). Similarly, there were no differences in recurrence-free survival comparing the same time intervals among patients who underwent FS-SLNB (Figure 5) with patients who underwent PS-SLNB (Figure 6).

Type of SLNB and overall survival. Overall, during the study period, we had 12 patients who died from their disease

Table II. *Distribution by clinicopathological parameters, overall and by type of sentinel lymph node biopsy (SLNB).*

Parameter	Subgroup	Overall n (%)	FS-SLNB n (%)	PS-SLNB n (%)	*p*-Value
Age	≤40 Years	31 (7.3)	26 (12.0)	5 (2.4)	<0.001
	>40 Years	391 (92.7)	191 (88.0)	200 (97.6)	
	Total	422 (100.0)	217 (100.0)	205 (100.0)	
Histology	IDC	218 (51.9)	107 (49.8)	111 (54.1)	0.220
	ILC	125 (29.8)	73 (33.9)	52 (25.4)	
	Other type	77 (18.3)	35 (16.3)	42 (20.5)	
	Total	420* (100.0)	215* (100.0)	205 (100.0)	
Grading	G1	108 (25.7)	44 (20.5)	64 (31.2)	0.030
	G2	189 (45.0)	100 (46.5)	89 (43.4)	
	G3	123 (29.3)	71 (33)	52 (25.4)	
	Total	420* (100.0)	215* (100.0)	205 (100.0)	
LVSI	Absent	310 (73.8)	135 (62.8)	175 (85.4)	<0.001
	Present	110 (26.2)	80 (37.2)	30 (14.6)	
	Total	420* (100.0)	215* (100.0)	205 (100.0)	
ER	Negative	47 (11.1)	22 (10.1)	25 (12.2)	0.538
	Positive	375 (88.9)	195 (89.9)	180 (87.8)	
	Total	422 (100.0)	217 (100.0)	205 (100.0)	
PgR	Negative	81 (19.2)	39 (18.0)	42 (20.5)	0.538
	Positive	341 (80.8)	178 (82.0)	163 (79.5)	
	Total	422 (100.0)	217 (100.0)	205 (100.0)	
HER2	Negative	370 (87.7)	186 (85.7)	184 (89.8)	0.237
	Positive	52 (12.3)	31 (14.3)	21 (10.2)	
	Total	422 (100.0)	217 (100.0)	205 (100.0)	
Ki-67	≤20%	221 (25.4)	110 (50.7)	111 (54.1)	0.496
	>20%	201 (47.6)	107 (49.3)	94 (45.9)	
	Total	422 (100.0)	217 (100.0)	205 (100.0)	
Biological subtype	Luminal A	208 (49.3)	103 (47.5)	105 (51.2)	0.393
	Luminal B	129 (30.6)	69 (31.8)	60 (29.3)	
	HER2+	52 (12.3)	31 (14.3)	21 (10.2)	
	TNBC	33 (7.8)	14 (6.4)	19 (9.3)	
	Total	422 (100.0)	217 (100.0)	205 (100.0)	
pT stage	ypT0	2 (0.5)	2 (0.9)	0 (0.0)	<0.001
	ypT1	20 (4.7)	14 (6.5)	6 (2.9)	
	pT1	315 (74.7)	139 (64.1)	176 (85.9)	
	ypT2	9 (2.1)	9 (4.1)	0 (0.0)	
	pT2	73 (17.3)	51 (23.5)	22 (10.7)	
	pT3	3 (0.7)	2 (0.9)	1 (0.5)	
	Total	422 (100.0)	217 (100.0)	205 (100.0)	
pN stage	pN0	289 (68.5)	124 (57.1)	165 (80.5)	<0.001
	ypN0	21 (4.9)	15 (6.9)	6 (2.9)	
	pN1	87 (20.6)	54 (24.9)	33 (16.1)	
	ypN1	7 (1.7)	7 (3.2)	0 (0.0)	
	pN2	10 (2.4)	9 (4.2)	1 (0.5)	
	ypN2	2 (0.5)	2 (0.9)	0 (0.0)	
	pN3	5 (1.2)	5 (2.3)	0 (0.0)	
	ypN3	1 (0.2)	1 (0.5)	0 (0.0)	
	Total	422 (100.0)	217 (100.0)	205 (100.0)	<0.001
AJCC stage	I	300 (71.4)	127 (59.1)	173 (84.4)	
	II	102 (24.3)	71 (33.0)	31 (15.1)	
	III	18 (4.3)	17 (7.9)	1 (0.5)	
	Total	420* (100.0)	215* (100.0)	205 (100.0)	

AJCC: American Joint Committee on Cancer; ER: estrogen receptor; FS: frozen section; HER2: human epidermal growth factor receptor 2; IDC: invasive ductal carcinoma; ILC: invasive lobular carcinoma; LVSI: lymphovascular space invasion; PgR: progesterone receptor; PS: permanent section; TNBC: triple-negative breast cancer. *Histology, grading and LSVI of two patients were not known because of complete pathological response after neoadjuvant chemotherapy, their remaining parameters were obtained from the preoperative biopsy.

Table III. *Distribution by clinicopathological parameters according to the time period of biopsy.*

Parameter	Subgroup	2004-2010 n (%)	2011-2020 n (%)	*p*-Value
Age	≤40 Years	13 (8.8)	18 (6.6)	0.436
	>40 Years	135 (91.2)	256 (93.4)	
	Total	148 (100.0)	274 (100.0)	
Histology	IDC	69 (46.6)	149 (54.8)	0.164
	ILC	50 (33.8)	75 (27.6)	
	Other type	29 (19.6)	48 (17.6)	
	Total	148 (100.0)	274 (100.0)	
Grading	G1	40 (27.0)	68 (25.0)	0.742
	G2	68 (46.0)	121 (44.5)	
	G3	40 (27.0)	83 (30.5)	
	Total	148 (100.0)	272* (100.0)	
LVSI	Absent	91 (61.5)	219 (80.5)	<0.001
	Present	57 (38.5)	53 (19.5)	
	Total	148 (100.0)	272* (100.0)	
ER	Negative	13 (8.8)	34 (12.4)	0.259
	Positive	135 (91.2)	240 (87.6)	
	Total	148 (100.0)	274 (100.0)	
PgR	Negative	25 (16.9)	56 (20.4)	0.438
	Positive	123 (83.1)	218 (79.6)	
	Total	148 (100.0)	274 (100.0)	
HER2	Negative	132 (89.2)	238 (86.9)	0.538
	Positive	16 (10.8)	36 (13.1)	
	Total	148 (100.0)	274 (100.0)	
Ki-67	≤20%	87 (58.8)	134 (48.9)	0.065
	>20%	61 (41.2)	140 (51.1)	
	Total	148 (100.0)	274 (100.0)	
Biological subtype	Luminal A	81 (54.7)	127 (46.4)	0.435
	Luminal B	41 (27.7)	88 (32.1)	
	HER2+	16 (10.8)	36 (13.1)	
	TNBC	10 (6.8)	23 (8.4)	
	Total	148 (100.0)	274 (100.0)	
pT stage	ypT0	0 (0.0)	2 (0.7)	0.433
	ypT1	4 (2.7)	16 (5.8)	
	pT1	111 (75.0)	204 (74.5)	
	ypT2	4 (2.7)	5 (1.8)	
	pT2	27 (18.2)	46 (16.8)	
	pT3	2 (1.4)	1 (0.4)	
	Total	148 (100.0)	274 (100.0)	
pN stage	pN0	100 (67.6)	189 (68.9)	0.608
	ypN0	3 (2.0)	18 (6.6)	
	pN1mi	16 (10.8)	28 (10.2)	
	ypN1mi	1 (0.7)	2 (0.7)	
	pN1	17 (11.5)	26 (9.5)	
	ypN1	3 (2.0)	1 (0.4)	
	pN2	5 (3.4)	5 (1.8)	
	ypN2	1 (0.7)	1 (0.4)	
	pN3	2 (1.3)	3 (1.1)	
	ypN3	0 (0.0)	1 (0.4)	
	Total	148 (100.0)	274 (100.0)	0.715
AJCC stage	I	101 (68.2)	199 (73.1)	
	II	39 (26.4)	63 (23.2)	
	III	8 (5.4)	10 (3.7)	
	Total	148 (100.0)	272** (100.0)	

AJCC: American Joint Committee on Cancer; ER: estrogen receptor; HER2: human epidermal growth factor receptor 2; IDC: invasive ductal carcinoma; ILC: invasive lobular carcinoma; LVSI: lymphovascular space invasion; PgR: progesterone receptor; TNBC: triple-negative breast cancer. *Histology, grading and LSVI of two patients were not known because of complete pathological response after neoadjuvant chemotherapy, the remaining parameters were obtained from the preoperative biopsy. **In cases of pathological complete response (ypT0ypN0cM0), AJCC stage was not assigned.

(2.9%), with a mean duration of survival of 60.8±42.6 months. Deaths occurred in 4.6% (10/217) in the FS-SLNB group and in 1.0% (2/205) in the PS-SLNB group (p=0.03). Overall survival was not significantly different, neither by type of SLNB nor by treatment era (data not shown).

Discussion

We found that the use of FS-SLNB dramatically declined at our Institution during the span of time under consideration, in favor of PS-SLNB. Hence, we moved from 100% of patients being submitted to FS-SLNB in 2004 to only 18.2% in 2020. A similar trend was reported in previous studies (19-21). This change in the management of SLNB for patients with breast cancer not only did not result in an increase in the reoperation rate for complete AD in patients undergoing PS-SLNB, but was even associated with a significant reduction of AD overall. This outcome may seem surprising, however, if we analyze the factors that over time led to this result, we can understand the reason. One of the main drawbacks of FS-SLNB is its relative inaccuracy, with as much as 18.7% of false-negative results in this series (Figure 1), in accordance with the literature (22-24). Another major inconvenience of FS-SLNB is the significantly longer operative time associated with its use. Indeed, the time needed to transfer the SLN to the pathology laboratory and to process it implied a considerable prolongation of the surgical procedure. For these reasons, especially after publication of the ACOSOG Z0011 and IBCSG 23-01 trials (11, 25), at our Institution there was a tendency to reduce the use of FS-SLNB, maintaining it only in cases with strong suspicion of lymph node metastasis (young age, large tumor volume, high tumor grade, *etc*.). A similar trend was reported by others (19, 26). The relatively low rate (15.6%) of positive SLNBs in the PS group may seem surprising; however, it results from an accurate selection of women candidates for this approach. In fact, at our Institution, ultrasound scan of the axillary nodes is always used in the preoperative work-up, along with other parameters, to identify patients at risk for lymph node metastases, as described in detail elsewhere (16, 17, 27-30). Therefore, patients with suspicious nodes are either submitted to preoperative ultrasound-guided core biopsy of the node or to FS-SLNB. Firstly, the changes in the policy for management of micrometastasis (31-33) and then the 'revolution' introduced by the publication of the ACOSOG Z0011 and IBCSG 23-01 trials (4, 11, 25) greatly contributed to reducing the number of patients undergoing reoperation for AD following the diagnosis of metastasis in the SLNB. This occurred at our Institution as well as in many other clinical settings around the world (34).

The policy of the reduced use of FS-SLNB that took place in recent years has allowed a considerable number of patients to be spared complete AD and, at the same time, has led to a

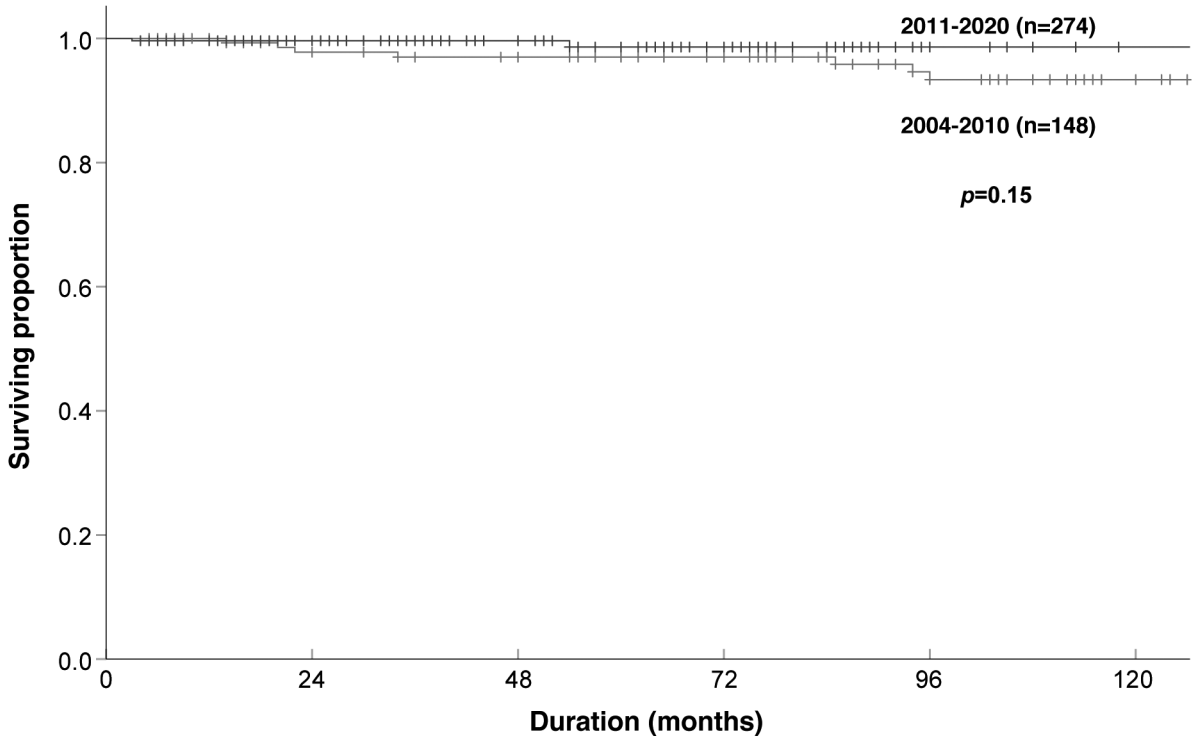

Figure 4. *Regional recurrence-free survival by study period: All patients*.

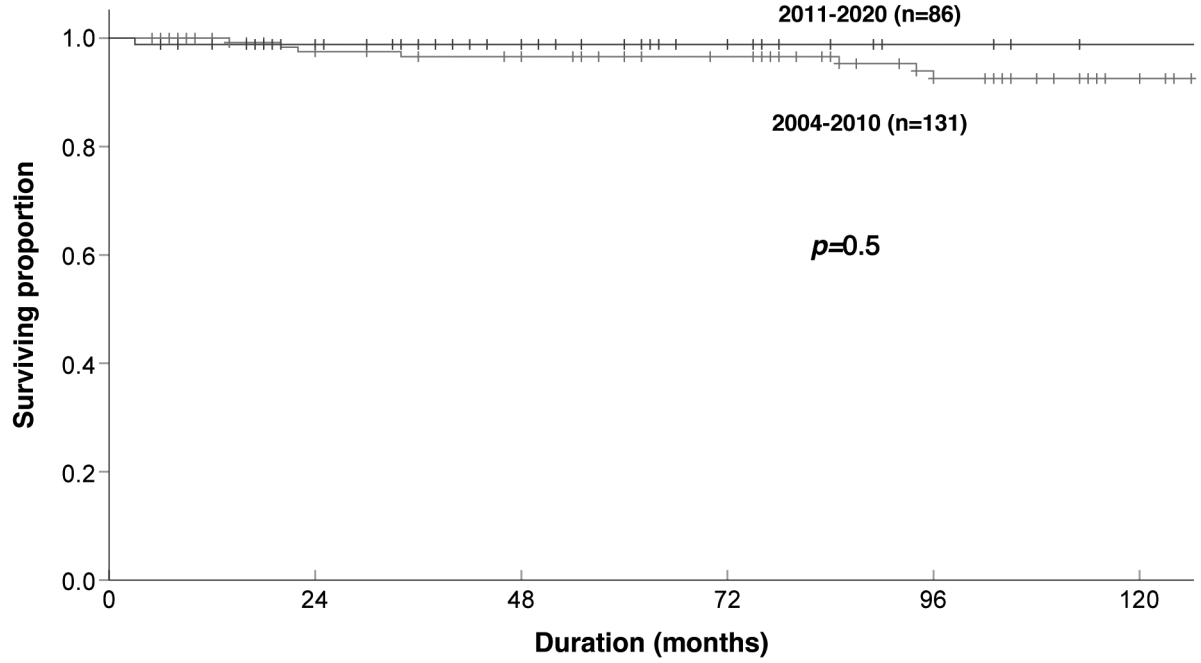

Figure 5. *Regional recurrence-free survival by period of frozen section sentinel lymph node biopsy.*

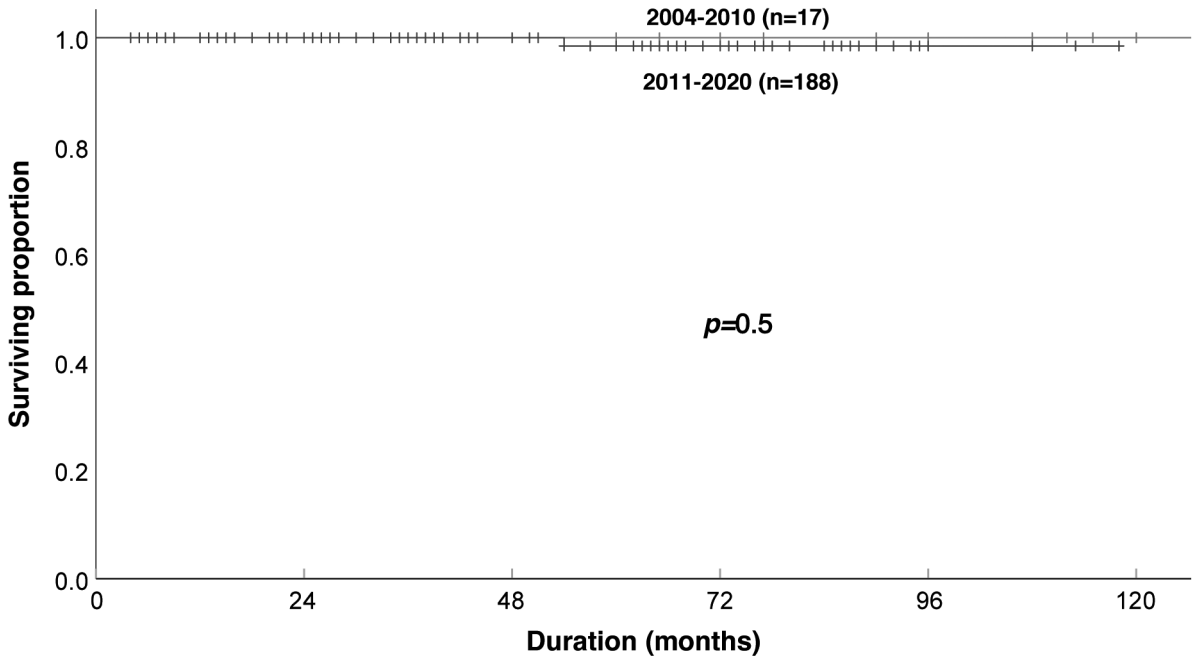

Figure 6. *Regional recurrence-free survival by period of permanent section sentinel lymph node biopsy.*

significant reduction of the operative time (35). This latter aspect may seem of secondary importance. On the contrary, we believe that the practical advantage of shortening the operative time may offer relevant benefits for both patients and the community. Hence, women undergoing a shorter operation will recover more promptly. On the other hand, the reduction of the operative time may allow one or two more procedures to be scheduled every day in the surgical theatre, with considerable economical savings and boosted clearance of the waiting list. The reduction in health care costs associated with this change in management of SLNBs has also been highlighted by others (20, 36-40). However, others reported opposite conclusions, claiming an increase in costs with the use of PS-SLNB in consideration of a higher reoperation rate (41). As already pointed out, this was not the case in our series, in which patients undergoing PS-SLNB had a significantly reduced rate of reintervention for AD.

Another interesting outcome of the current study was that the reduced use of FS-SLNB and the corresponding lower number of complete AD in the later years, did not result in an increase of regional lymphatic recurrences. Of note, patients who underwent FS-SLNB even had a significantly higher rate of regional recurrences in comparison to patients submitted to PS-SLNB. However, this finding must be interpreted with caution because lymphatic regional recurrences occurred after a mean of almost 4 years from surgery and the cohort of patients undergoing PS-SLNB had a relatively shorter follow-up. Nevertheless, regional lymphatic recurrence-free survival did not significantly differ by study period overall (Figure 4), nor in groups by SLNB type (Figure 5 and Figure 6). Similarly, no difference in overall survival was found in these groups. Therefore, our results seem to support the feasibility and the safety of this policy in minimizing the use of FS-SLNB.

A limitation of our study may be represented by the relatively small number of patients included in a relatively long timespan. For this reason, we do not pretend to be able to draw any definitive conclusion. However, this study retrospectively analyzed the experience of a single institution, in a real-life setting, and this may also be considered one of its strengths.

Conclusion

We found that the reduced use of FS-SLNB in recent years did not result in an increased risk of reintervention for AD. On the contrary, the preferential use of PS-SLNB resulted in a significant reduction of AD and a shorter operative time, without any significant difference in regional recurrence-free or overall survival. Therefore, in our experience, this approach to SLNB was feasible and safe and provided benefits for both patients and the community.

Conflicts of Interest

All Authors declare that there are no conflicts of interest regarding this study.

Authors' Contributions

Conceptualization, T.S.; methodology, TS.; software, I.R.; formal analysis, I.N.; investigation, T.S., J.N., E.V. and S.B.; data curation, I.N. and M.G.; writing – original draft preparation, I.N.; writing – review and editing, T.S.; visualization, I.R. and M.G.; supervision, S.B.

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